APR 29 1999

FLOOD INSURANCE STUDY

CITY OF IRVING, TEXAS
DALLAS COUNTY

REVISED:
JULY 17, 1989

Federal Emergency Management Agency

COMMUNITY NUMBER - 480180

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance study purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgments	1
	1.3 Coordination	2
2.0	AREA STUDIED	2
	2.1 Scope of Study	2
	2.2 Community Description	5
	2.3 Principal Flood Problems	6
	2.4 Flood Protection Measures	7
3.0	ENGINEERING METHODS	7
	3.1 Hydrologic Analyses	8
	3.2 Hydraulic Analyses	11
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	13
	4.1 Flood Boundaries	13
	4.2 Floodways	13
5.0	INSURANCE APPLICATION	22
	5.1 Reach Determinations	22
	5.2 Flood Hazard Factors	22
	5.3 Flood Insurance Zones	22
	5.4 Flood Insurance Rate Map Description	27
6.0	OTHER STUDIES	27

TABLE OF CONTENTS - continued

	Page
7.0 LOCATION OF DATA	28
8.0 BIBLIOGRAPHY AND REFERENCES	28

FIGURES

Figure 1 - Vicinity Map	3
Figure 2 - Floodway Schematic	21

TABLES

Table 1 - Summary of Discharges	9 - 11
Table 2 - Floodway Data	15 - 20
Table 3 - Flood Insurance Zone Data	23 - 26

EXHIBITS

Exhibit 1 - Flood Profiles

West Fork of Trinity River	Panels 01P-04P
Elm Fork of Trinity River	Panels 05P-11P
Bear Creek	Panels 12P-15P
Dry Creek	Panels 16P-19P
Estelle Creek	Panels 20P-22P
Delaware Creek	Panels 23P-25P
West Irving Branch	Panels 26P-27P
Stream 7C2	Panels 28P-29P
Hackberry Creek	Panels 30P-32P
Cottonwood Branch	Panels 33P-37P
South Fork of Hackberry Creek	Panels 38P-40P
Mud Springs Creek	Panel 41P
Grapevine Creek	Panels 42P-43P

Exhibit 2 - Flood Boundary and Floodway Map Index
Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CITY OF IRVING, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Irving, Dallas County, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses in this study represent a revision of the original analyses prepared by the U. S. Army Corps of Engineers (COE), Fort Worth District, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-H-7-76, Project Order No. 21, and Inter-Agency Agreement No. IAA-H-10-77, Project Order No 2 and amendments thereto. This work was completed in March 1979, and the study was effective on May 19, 1980.

In the first revision, an updated hydraulic analysis for the Elm Fork of Trinity River was prepared by Albert H. Halff Associates, Inc., under agreement with FEMA. This work was completed in November 1981. This revision also included an updated hydraulic analysis for South Fork of Hackberry Creek, which was prepared by Lockwood, Andrews, and Newman, Inc., under agreement with FEMA. This work was completed in August 1982. These revisions were effective on March 29, 1983.

A second revision was done to revise the hydraulic analysis for the West Fork of Trinity River. This study was prepared by the COE, Fort Worth District, under agreement with FEMA. The work for the second revision was completed in November 1982, and the revision was effective on June 15, 1984.

A third revision included updated hydraulic analyses for the Elm Fork of Trinity River and Delaware Creek. The revised hydraulic analysis for the Elm Fork of Trinity River was prepared by URS Engineers for FEMA. The revised hydraulic analysis for Delaware Creek was prepared by Sherrill Engineering Consultants, Inc., for FEMA. The work for this revision was completed in May 1984, and the revision was effective on February 5, 1986.

This revision includes updated hydrologic and hydraulic analyses for the Elm Fork of Trinity River prepared by the Fort Worth District of the COE, under agreement with FEMA. This work was completed in September 1986.

1.3 Coordination

On July 14, 1976, an initial Consultation and Coordination Officer's (CCO) meeting was held to identify the streams to be studied by detailed methods and to select a community base map. This meeting was attended by the Community Executive Officer (CEO), the Community Coordination Officer, and representatives of the Texas Department of Water Resources (TDWR) and the COE (the study contractor). The Soil Conservation Service (SCS), the U. S. Geological Survey (USGS), the State Department of Highways and Public Transportation, and TDWR were contacted for information related to the study.

An intermediate coordination meeting, attended by FEMA and the study contractor, was held on September 13, 1979, to review the preliminary results of this study. On December 19, 1979, a final CCO meeting, attended by representatives of the City of Irving, FEMA, and the study contractor, was held to review the results of the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Irving, Dallas County, Texas. The area of study is shown on the Vicinity Map (Figure 1).

The following streams were studied by detailed methods: the West Fork of Trinity River, from its confluence with the Trinity River to a point approximately 0.6 mile upstream of Beltline Road; Elm Fork

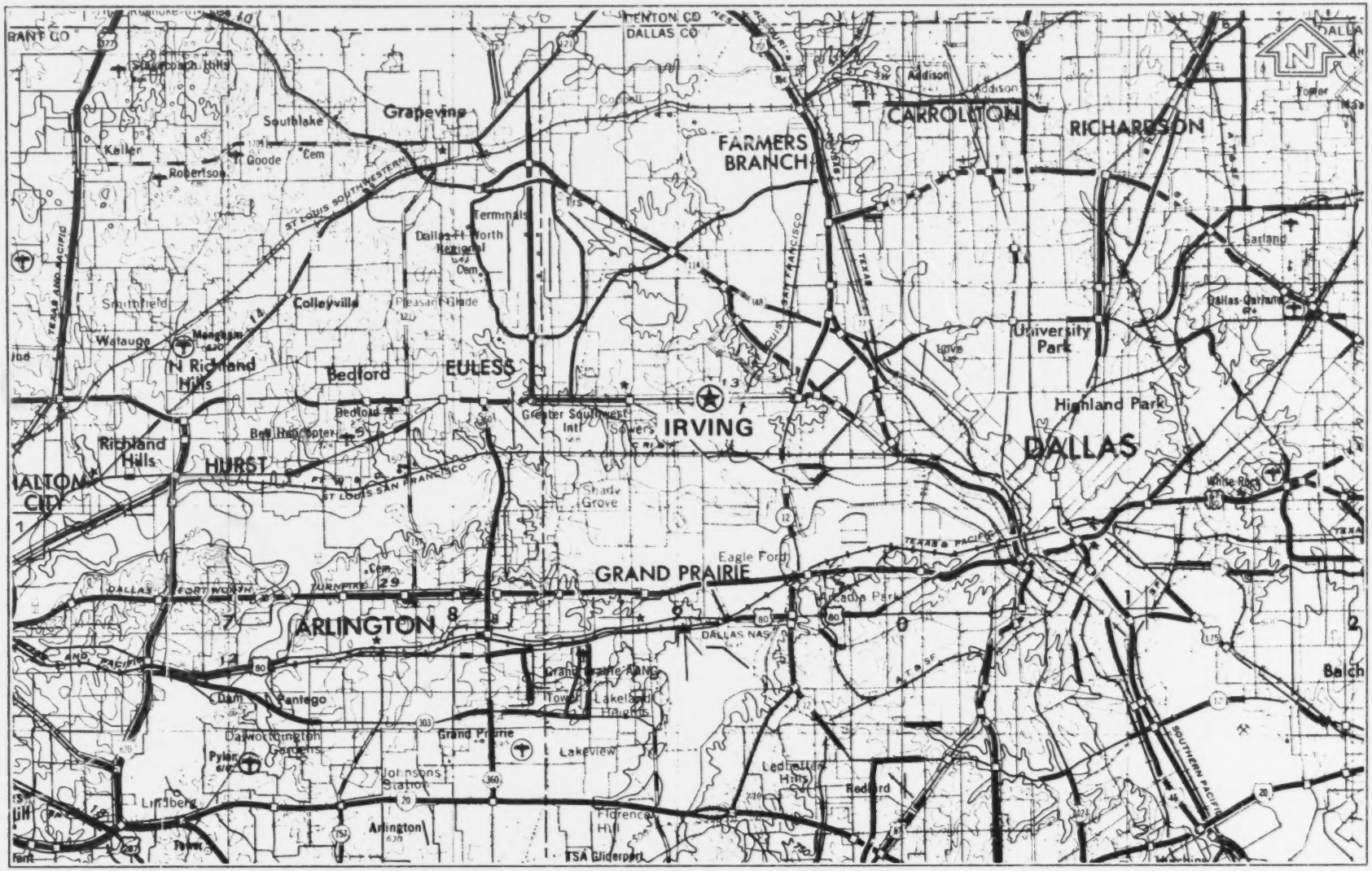


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX

(DALLAS CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

of Trinity River, from its confluence with the Trinity River to Beltline Road; Bear Creek, from its confluence with the West Fork of Trinity River to a point approximately 1,600 feet upstream of County Line Road; Dry Creek, from its confluence with Bear Creek to approximately 1,300 feet upstream of Pocatello Drive; Estelle Creek, from its confluence with Bear Creek to a point approximately 0.7 mile upstream of Northgate Drive; Delaware Creek, from its confluence with the West Fork of Trinity River to the upstream side of Story Road; West Irving Branch, from a point approximately 2,500 feet downstream of Oakdale Road to the upstream side of Story Road; Stream 7C2, from its confluence with the Elm Fork of Trinity River to a point approximately 1,750 feet upstream of Brook Hollow Drive; Hackberry Creek, from its confluence with the Elm Fork of Trinity River to Esters Road (extended); Cottonwood Branch, from its confluence with Hackberry Creek to approximately 0.8 mile upstream of Beltline Road; South Fork of Hackberry Creek, from its confluence with Hackberry Creek to the upstream side of Valley View Lane; Mud Springs Creek, from its confluence with Hackberry Creek to a point approximately 1,850 feet upstream; and Grapevine Creek, from its confluence with the Elm Fork of Trinity River to approximately 700 feet upstream of County Line Road.

In the first revision, changes were made to reflect levee improvements along the Elm Fork of Trinity River between Valley View Lane and Ledbetter Road. Channel improvements on the South Fork of Hackberry Creek between State Route 114 and Trigg Road were also incorporated.

The second revision incorporated the effects of the Irving and Grand Prairie landfills along the West Fork of Trinity River between State Loop 12 and Beltline Road.

The third revision incorporated updated hydraulic analyses for the Elm Fork of Trinity River for its entire length within the community and for Delaware Creek from Story Road to a point approximately 800 feet downstream. In addition, the third revision includes map changes reflecting the following previously effective Letters of Map Revision: 1) October 21, 1983 - "Towne Lake Phase II," floodplain modifications to Bear Creek north of Rock Island Road; 2) November 17, 1983 - "Town Lake Phase I," channel modifications to Bear Creek and Estelle Creek at their confluence; 3) March 2, 1984 - "Irving Mall," channel modifications to Dry Creek between State Route 183 and Pocatello Drive; 4) July 13, 1984 - "Town Lake Phase III," floodplain modifications to Bear Creek north of Rock Island Road; and 5) July 25, 1984 - "Metroport Central Addition," channel modifications to Estelle Creek between State Route 183 and Rochelle Road.

This revision incorporated updated hydrologic and hydraulic analyses for the Elm Fork of Trinity River for its entire stream length

within the community. In addition, this revision includes map changes reflecting previously issued Letters of Map Revision: 1) October 7, 1985 - channelization of Stream 7C2 from West Frontage Road (Loop 12) to a point approximately 570 feet upstream; 2) August 26, 1986 - channel modification project on Hackberry Creek between MacArthur Boulevard and State Route 114; and 3) February 7, 1986 - Irving Flood Control District, Section III levee and channel modifications along the Elm Fork of Trinity River and Grapevine Creek. The updated analyses for the Elm Fork of Trinity River supersede those in the February 7, 1986, Letter of Map Revision; however, the analyses for Grapevine Creek are reflected in this revision.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

Portions of Hackberry Creek, Grapevine Creek, South Fork of Hackberry Creek, Estelle Creek, Dry Creek, Cottonwood Branch, Delaware Creek, and several unnamed tributaries were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the City of Irving.

2.2 Community Description

Irving is situated in the fork of the West Fork of Trinity River and the Elm Fork of Trinity River and lies in northwest Dallas County. The city is bordered by the City of Grand Prairie to the south; the unincorporated areas of Tarrant County and the City of Grapevine to the west; the City of Coppell to the north; and the Cities of Dallas, Farmers Branch, and Carrollton to the east. The Texas Municipal League lists the estimated 1976 population as 118,974, an increase of 21,714 over the 1970 population. This represents an increase of 22 percent in 6 years.

Irving is a rapidly growing residential, distribution, and manufacturing center with varied industries. The D/FW Regional Airport, which lies partially in Irving, is the nation's largest airport. Texas Stadium, the home of the Dallas Cowboys football team, is also located in Irving. Most of the existing development in the community lies in the central and south-central part of the city. Rapid residential development is taking place in the northern part of the city.

The southwest part of the city is drained by the West Fork of Trinity River and its tributaries. The Irving area has terrain characteristic of the Blackland Prairie. The topography is gently rolling to almost level with narrow streams well incised. The soils

in the area are mainly of the Houston Black, Haiden, and Austin series. The native vegetation consists of bunch and short grasses, with scattered mesquite trees on the uplands and hardwood trees of elm, hackberry, and pecan occurring along the streams.

The climate of the region is warm, temperate, and humid. Summers are hot, and winters are short and mild. Extremes of temperatures and precipitation are of relatively short duration. The annual mean precipitation is approximately 35 inches. The mean relative humidity is 63 percent, and the average temperature is 65.8 degrees Fahrenheit (^{o}F). The record temperature extremes range from a maximum of 111^{o}F in July 1954 to a minimum of -3^{o}F in January 1930.

2.3 Principal Flood Problems

Most of the flood producing storms that occur in the Irving area are experienced in the spring and fall. Most of the higher floods that have occurred in the general geographical region have resulted from prolonged or successive storms that produced heavy rainfall during this period; however, severe flooding can be produced by intense local thunderstorms at any time.

The flood of record on the Elm Fork of Trinity River near Irving prior to construction of the upstream reservoirs occurred in May 1908. An estimated discharge of 145,000 cubic feet per second (cfs) was experienced. The second largest discharge of record was 90,700 cfs, which occurred in April 1942. Based on reservoir regulation studies, the existing upstream reservoirs would have reduced the 1908 flood near Irving from 145,000 cfs to 26,000 cfs, and the 1942 flood would have been reduced from 90,700 cfs to 24,100 cfs. In September 1964, a flow of 33,000 cfs was experienced at the Carrollton gage. This flow was generated entirely from the uncontrolled area and approaches the magnitude of the 100-year flood in the Irving area (Reference 1).

The flood of May 1908 produced water-surface elevations 5 feet above the flood of May 1957; however, discharge estimates for this flood are not available. The flood of May 1957 produced a discharge of 59,200 cfs at the Grand Prairie gage and would have a recurrence interval of approximately once in 50 years based on present conditions. The flood of May 1949 produced a discharge of 62,000 cfs; however, this discharge measurement was affected by major levee breaks. Other large floods are known of have occurred in April 1942 and March 1945 (Reference 2).

Large floods are known to have occurred on Delaware Creek in the early 1930's and in 1957. The flood in the early 1930's was described as being larger than the 1957 flood, and the 1957 flood was described as larger than any flood since that time. Other floods are known to have occurred on Delaware Creek in April 1963, May 1965, April 1966, and May 1969. Discharge estimates for these floods are not available.

The COE estimated damages from the April 1966 flood to be between $150,000 and $200,000 on Delaware Creek and its tributaries (Reference 3) Little factual flood data were available for the other streams in Irving. It should be noted that the frequencies assigned to the historical floods should be viewed with caution since the estimates were made by comparing high-water marks or discharge estimates obtained from historical records with determinations made in connection with this or adjacent studies. It is seldom possible to determine the conditions that existed at the sites of the historical high-water mark or discharge estimate.

The hydrologic determinations for this study are based on existing stream and watershed conditions that may differ from the conditions that existed at the time of the historical flood. Additionally, the estimates may not be valid except in the immediate area of the estimate.

2.4 Flood Protection Measures

There are several existing local interest levees along the left bank of the Elm Fork of Trinity River in Irving. The Irving Flood Control District Section III levees are located along the Elm Fork of the Trinity River and Grapevine Creek. FEMA specifies that all levees must have a minimum of 3 foot freeboard against 100-year flooding to be considered a safe flood protection structure. These levees do meet the FEMA freeboard requirement, and they also provide protection from the 500-year frequency flood. Additionally, several reaches of stream straightening and/or enlarging have taken place in connection with subdivision development and road construction. The City of Irving currently regulates floodplain development through a zoning ordinance.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is

approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The hydrologic procedures used in developing discharge-frequency curves for the West Fork of Trinity River are based on the method recommended in Water Resources Council Bulletin 17 (Reference 4). Historical discharge-frequency curves were developed at six gages in the Trinity River basin near Dallas. The final discharge-frequency curve for each location is a composite curve using observed discharge data with consideration given to rare hypothetical floods. The 100- and 500-year events are based on the values reflected by the composite or final curves plotted on log probability paper. The only stream gage on the Elm Fork of Trinity River is located at Sandy Lake Road at Carrollton, Texas, approximately 2 miles north of the Irving corporate limits. The West Fork of Trinity River gage is located at Beltline Road in Grand Prairie, Texas, approximately 1 mile south of the Irving corporate limits. Each of the remaining streams were divided into subareas, and synthetic unit and flood hydrographs were developed at selected locations.

In this study, the revised hydrologic analysis for the Elm Fork of Trinity River utilized the NUDALLAS computer program to develop the discharge-frequency relationships (Reference 5).

National Weather Service Technical Paper No. 40 was used in developing the 10-, 50-, and 100-year storms (Reference 6). The 500-year storm was based on extrapolated data. Frequency peak discharges at selected locations were computed. Additionally, headwater areas of less than 1 square mile were modeled using the rational method. In that method, the following equation was used:

$$Q = CIA$$

where Q is the peak discharge in cfs, C is a runoff coefficient, I is the rainfall intensity in inches per hour for the watershed time of concentration, and A is the drainage area in acres. The decrease in peak discharge with an increase in drainage area for some streams is due to watershed shape and/or overbank storage effects.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
WEST FORK OF TRINITY RIVER					
At USGS gage at Beltline Road	3,070[1]	28,000	60,000	79,000	153,000
ELM FORK OF TRINITY RIVER					
At confluence with Trinity River	2,574	19,500	33,850	42,700	63,050
Above confluence of Bachman Branch	2,569	19,850	34,350	43,200	63,500
Above confluence of Joe's Creek	2,555	20,250	34,150	42,650	62,100
Above confluence of Hackberry Creek	2,533	22,100	36,800	45,350	66,500
Above confluence of Farmers Branch Creek	2,512	23,050	37,400	45,300	63,700
Above point approximately 120 feet downstream of Valley View Lane	2,498	23,150	37,400	45,100	63,100
Above confluence of Cooks Branch	2,493	23,100	36,900	44,650	62,700
At USGS gage at Sandy Lake Road	2,458[1]	24,300	37,100	44,350	60,400
BEAR CREEK					
At mouth	93.80	15,000	24,890	30,230	40,390
Between Beltline and Shady Grove Roads	82.22[1]	16,820	27,780	33,510	44,290
At State Route 183	74.89[1]	17,200	28,330	34,000	44,910
DRY CREEK					
At mouth	3.31	4,350	6,000	6,700	8,500
At Rock Island Road	2.40	3,550	4,900	5,500	6,900
At State Route 183	1.30	2,450	3,350	3,750	4,650
ESTELLE CREEK					
At mouth	3.15	3,600	5,000	5,600	7,100
Below left bank tributary approximately 300 feet above State Route 183	2.88	3,950	5,400	6,000	7,600

[1]Outside corporate limits

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
ESTELLE CREEK (continued)					
Below left bank tributary approximately 2,950 feet above State Route 183	2.35	3,700	5,000	5,600	7,100
Above left bank tributary approximately 2,950 feet above State Route 183	2.09	3,300	4,500	5,000	6,300
Above left bank tributary approximately 6,100 feet above State Route 183	1.37	2,350	3,200	3,600	4,500
DELAWARE CREEK					
At mouth	9.23	9,400	13,000	14,600	18,500
Below Oakdale Road	7.55	9,500	13,100	14,700	18,500
Below Chicago, Rock Island and Pacific Railroad	5.86	9,500	13,100	14,600	18,300
Below left bank tributary approximately 2,300 feet above Sowers Road	4.36	7,000	9,600	10,800	13,500
Above left bank tributary approximately 2,300 feet above Sowers Road	3.51	5,500	7,600	8,500	10,600
At State Route 183	1.32	2,500	3,400	3,800	4,750
WEST IRVING BRANCH					
Approximately 2,000 feet below Oakdale Road	3.17	4,450	6,100	6,900	8,600
At Rogers Road	2.58	4,550	6,200	6,900	8,700
At Chicago, Rock Island and Pacific Railroad	1.52	2,850	3,900	4,350	5,400
STREAM 7C2					
Approximately 500 feet below Wildwood Street	1.71	3,750	4,950	5,400	6,700
At Loop 12	1.39	2,600	3,550	4,000	5,100

TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
HACKBERRY CREEK					
At mouth	21.22	13,300	18,900	21,400	27,700
Above confluence of Cottonwood Branch	15.13	9,400	13,400	15,200	19,600
Below confluence of South Fork of Hackberry Creek	13.66	11,000	15,400	17,300	22,100
Above confluence of South Fork of Hackberry Creek	10.44	8,200	13,200	14,900	18,900
Below confluence of Mud Springs Creek	5.45	8,000	11,000	12,300	15,500
Above confluence of Mud Springs Creek	1.76	3,050	4,150	4,600	5,800
COTTONWOOD BRANCH					
At mouth	4.69	4,300	6,000	6,700	8,600
At Story Road	2.76	4,100	5,700	6,300	8,000
At Baltimore Road	1.06	2,000	2,750	3,050	3,800
SOUTH FORK OF HACKBERRY CREEK					
At mouth	3.22	3,450	4,800	5,400	6,800
At Gateway Drive	2.06	2,800	3,850	4,300	5,400
At Beltline Road	1.05	1,850	2,550	2,850	3,600
MUD SPRINGS CREEK					
At mouth	3.69	5,200	7,100	8,000	10,100
GRAPEVINE CREEK					
At mouth	11.48	5,900	8,600	9,700	12,700
At intersection with extension of Cotton Road	5.95[1]	7,300	10,000	11,200	14,200
At Radio Road	3.68	5,100	7,000	7,900	9,900
At State Route 114	2.77	4,900	6,700	7,500	9,400

[1]Outside corporate limits

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross section for the backwater analyses of the streams studied by detailed methods were field surveyed. Cross sections were located at close intervals above or below bridges and culverts in order to compute the significant backwater effects of these structures.

For the revised hydraulic analysis of the Elm Fork of Trinity River in this study, cross sections were obtained from: Texas State Highway Department bridge plans; field surveyed cross sections taken in 1945, 1970, 1976, and 1983; and from studies prepared by Albert H. Halff Associates, Inc., URS Engineers, Nathan D. Maier Consulting Engineers, Freese and Nichols, Inc., and Caffey and Morrison, Inc.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel roughness factors (Manning's "n") for these computations were assigned on the basis of field inspections of floodplain areas and on previous studies done by the COE. Channel and overbank "n" values for the streams studied by detailed methods are shown in the following tabulation:

Stream	Channel "n"	Overbank "n"
West Fork of Trinity River	0.035-0.055	0.050-0.120
Elm Fork of Trinity River	0.035-0.075	0.035-0.100
Bear Creek	0.040-0.055	0.065-0.080
Dry Creek	0.015-0.065	0.040-0.100
Estelle Creek	0.015-0.065	0.030-0.085
Delaware Creek	0.015-0.060	0.020-0.120
West Irving Branch	0.015-0.060	0.020-0.120
Stream 7C2	0.015-0.050	0.085-0.090
Hackberry Creek	0.040-0.065	0.065-0.085
Cottonwood Branch	0.015-0.065	0.055-0.075
South Fork of Hackberry Creek	0.016-0.060	0.016-0.0075
Mud Springs Creek	0.065	0.080-0.085
Grapevine Creek	0.045-0.055	0.060-0.080

Water-surface elevations of floods of the selected recurrence intervals for Elm Fork of Trinity River and each of the smaller streams were computed using the COE HEC-2 step-backwater computer program (Reference 7). Water-surface elevations for the West Fork of Trinity River were computed using the LRD-1 (Modified) water-surface profile computer program (Reference 8). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

Starting water-surface elevations for the streams studied by detailed methods except West and Elm Forks of Trinity River were

based on slope/area determinations. West and Elm Forks of Trinity River were based on coincident conditions on the Trinity River.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing floodplain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 9).

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown. The approximate boundaries were delineated as shown on the previously effective Flood Insurance Study for the City of Irving (Reference 10).

The 100- and 500-year floodplain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself.

One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as a minimum standard that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the floodplain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2). Portions of the floodway widths for the West Fork of Trinity River, the Elm Fork of Trinity River, Dry Creek, and Grapevine Creek extend beyond the corporate limits.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year floodplain boundaries are either close together or colinear, only the floodway boundary has been shown.

The floodways developed for the tributary streams entering the West Fork of Trinity River in the West Fork of Trinity River floodplain present special problems. A split flow situation exists on Bear Creek between Beltline Road and Shady Grove Road in the City of Grand Prairie. During the occurrence of a 100-year frequency flood, it is estimated that approximately 45 percent of the flow would cross Oakdale Road and enter the Trinity River above Beltline Road under present conditions. West Irving Branch empties into a series of gravel pits and has no discernible channel confluence with Bear Creek; therefore, a conservative approach was used in displaying the floodways shown for this area on the maps. Although some additional encroachment on the floodplains could possible be allowed in this area, it should be preceded by detailed engineering studies.

The Irving Flood Control District - Section III levees along Grapevine Creek and the Elm Fork of Trinity River have the floodway delineated on top of the levee. This was allowed since the District filed an ordinance that indicates that activities are prohibited on or near the levee that would affect its structural stability and integrity.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
West Fork of Trinity River								
A*	15,210[1]	4100/3400[3]	24,548	3.5	428.1	428.1	428.1	0.0
B	43,000[1]	4686/0[3]	38,998	2.0	438.3	438.3	439.3	1.0
Elm Fork of Trinity River								
A	21,000[1]	3008/260[3]	45,138	0.9	426.0	426.0	426.0	0.0
B	31,300[1]	3299/170[3]	36,935	1.2	426.9	426.9	427.1	0.2
C	37,250[1]	2985/80[3]	32,327	1.4	427.5	427.5	427.8	0.3
D	48,500[1]	3350/560[3]	33,616	1.3	429.5	429.5	429.8	0.3
E	55,300[1]	4080/700[3]	41,283	1.1	430.8	430.8	431.2	0.4
F	57,890[1]	3394/1660[3]	25,681	1.8	431.2	431.2	431.6	0.4
G	59,800[1]	1219/700[3]	15,981	2.7	433.4	433.4	433.6	0.2
H	62,950[1]	1161/750[3]	26,174	1.7	433.8	433.8	434.0	0.2
I	64,820[1]	2100/1480[3]	17,810	2.5	433.9	433.9	434.1	0.2
J	69,480[1]	2403/1280[3]	17,219	2.6	436.9	436.9	437.0	0.1
K	72,920[1]	3301/1810[3]	31,007	1.4	438.1	438.1	438.1	0.0
L	80,970[1]	3654/2190[3]	23,468	1.9	438.8	438.8	438.8	0.0
Bear Creek								
A	43,120[2]	1,448	12,709	2.7	471.0	471.0	472.0	1.0
B	44,470[2]	1,409	11,575	2.9	472.1	472.1	473.1	1.0
C	46,000[2]	1,430	8,937	3.8	473.4	473.4	474.3	0.9
D	47,180[2]	1,089	8,300	4.1	476.0	476.0	476.6	0.6

[1]Feet above confluence with Trinity River

[2]Feet above confluence with West Fork of Trinity River

[3]Width/width within corporate limits

*Located outside corporate limits; not shown on maps

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX

(DALLAS CO.)

FLOODWAY DATA

WEST FORK OF TRINITY RIVER - ELM FORK OF TRINITY RIVER - BEAR CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Dry Creek								
A	2,040	400	1,894	3.5	448.1	448.1	449.1	1.0
B	3,650	174/60[2]	1,015	6.6	456.2	456.2	457.1	0.9
C**	4,890	250/230[2]	1,371	4.9	462.1	462.1	462.7	0.6
D	7,580	299/0[2]	1,413	3.9	473.1	473.1	473.8	0.7
E	8,470	178	973	5.7	476.7	476.7	477.4	0.7
F	10,330	229	1,092	5.0	484.3	484.3	484.3	0.0
G	12,220	327	2,052	2.7	491.2	491.2	491.9	0.7
H	15,700	236	1,366	2.8	502.4	502.4	503.4	1.0
I	18,265	47	270	13.9	511.5	511.5	511.5	0.0
J	19,840	55	359	10.5	517.9	517.9	517.9	0.0
K	20,378	140	675	7.5	521.9	521.9	522.2	0.3
L	20,978	300	1,632	3.9	523.0	523.0	523.3	0.8
Estelle Creek								
A	1,515	72	722	7.8	475.3	475.3	475.3	0.0
B	2,115	180	1,903	2.9	476.6	476.6	477.0	0.4
C	2,615	192	2,197	2.5	478.7	478.7	479.3	0.6
D	3,015	106	1,028	5.4	478.7	478.7	479.2	0.5
E	3,615	92	869	6.4	480.0	480.0	480.7	0.7
F	4,696	*	528	10.2	485.8	485.8	485.8	0.0
G	5,596	*	382	14.1	487.3	487.3	487.3	0.0
H	5,996	*	402	13.9	489.2	489.2	489.2	0.0
I	6,596	*	401	14.0	491.6	491.6	491.6	0.0
J	7,196	*	401	14.0	494.0	494.0	494.0	0.0
K	7,447	250	910	5.5	498.3	498.3	498.3	0.0
L	9,097	300	1,711	2.9	504.7	504.7	505.7	1.0

[1]Feet above confluence with Bear Creek
[2]Width/width within corporate limits

*Floodway coincident with channel banks
**Located outside corporate limits; not shown on maps

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOODWAY DATA

DRY CREEK - ESTELLE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Estelle Creek (continued)								
M	10,157[1]	255	1,267	3.4	507.7	507.7	508.6	0.9
N	13,623[1]	251	1,037	3.5	513.0	513.0	513.8	0.8
O	16,693[1]	212	740	2.8	523.1	523.1	523.9	0.8
P	18,823[1]	153	586	3.6	531.1	531.1	531.8	0.7
Delaware Creek								
A	11,960[2]	314	1,619	9.1	432.4	432.4	433.0	0.6
B	16,440[2]	340	1,563	8.7	445.6	445.6	446.1	0.5
C	18,290[2]	257	2,184	6.2	458.2	458.2	458.9	0.7
D	19,030[2]	354	2,418	5.6	459.2	459.2	459.9	0.7
E	20,220[2]	313	2,085	7.0	465.8	465.8	466.7	0.9
F	22,250[2]	422	2,403	6.1	472.9	472.9	473.7	0.8
G	23,510[2]	628	6,116	2.2	480.3	480.3	481.0	0.7
H	25,220[2]	564	4,446	3.0	482.0	482.0	482.7	0.7
I	26,460[2]	456	2,442	4.7	483.5	483.5	484.1	0.6
J	27,510[2]	271	970	8.8	486.9	486.9	486.9	0.0
K	34,340[2]	234	1,290	3.3	518.6	518.6	519.2	0.6
L	36,030[2]	148	441	7.6	522.9	522.9	523.2	0.3
M	36,416[2]	206	474	7.1	525.6	525.6	525.6	0.0
N	36,920[2]	422	789	4.3	527.4	527.4	527.5	0.1

[1]Feet above confluence with Bear Creek

[2]Feet above confluence with West Fork of Trinity River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOODWAY DATA

ESTELLE CREEK - DELAWARE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
West Irving Branch								
A	4,963[1]	63	616	11.2	457.1	457.1	457.7	0.6
B	8,840[1]	286	1,624	4.2	466.4	466.4	467.1	0.7
C	10,980[1]	244	1,335	3.6	474.1	474.1	475.0	0.9
D	13,080[1]	376	961	4.9	485.1	485.1	485.2	0.1
E	13,350[1]	140	570	8.3	485.6	485.6	485.6	0.0
Stream 7C2								
A	3,500[2]	432	4,034	1.3	442.8	442.8	443.8	1.0
B	5,700[2]	110	488	8.2	448.8	448.8	449.2	0.4
C	6,950[2]	*	699	5.7	464.2	464.2	465.2	1.0
D	7,400[2]	191	1,241	3.2	464.8	464.8	465.6	0.8
E	8,080[2]	148	490	8.2	468.3	468.3	468.3	0.0
F	9,520[2]	105	422	5.2	474.1	474.1	474.9	0.8
Hackberry Creek								
A	3,585[2]	600	6,127	3.5	430.5	428.3[3]	428.9	0.6
B	4,450[2]	442	2,926	5.2	430.5	428.4[3]	429.4	1.0
C	5,040[2]	1,216	10,911	1.4	432.3	432.3	432.7	0.4
D	8,280[2]	836	6,153	2.5	432.9	432.9	433.9	1.0
E	10,500[2]	764	5,881	2.6	437.5	437.5	438.1	0.6
F	13,134[2]	149	4,519	2.9	441.6	441.6	441.9	0.3
G	14,472[2]	381	3,323	3.9	445.0	445.0	445.8	0.8
H	19,227[2]	310	6,323	2.4	451.8	451.8	451.9	0.1
I	20,327[2]	331	7,461	1.9	451.9	451.9	452.0	0.1
J	21,507[2]	210	4,463	3.2	451.9	451.9	452.4	0.5

[1]Feet above a point approximately 2,800 feet south of Oakdale Road *Floodway coincident with channel banks
[2]Feet above confluence with Elm Fork of Trinity River
[3]Elevation computed without consideration of backwater effects from Elm Fork of Trinity River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOODWAY DATA

WEST IRVING BRANCH - STREAM 7C2 - HACKBERRY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Hackberry Creek (continued)								
K	23,275[1]	474	4,962	2.3	468.4	468.4	468.6	0.2
L	25,396[1]	685	4,829	2.5	469.9	469.9	470.3	0.4
M	26,216[1]	509	3,027	4.1	471.7	471.7	472.1	0.4
N	28,146[1]	388	2,073	2.2	476.7	476.7	477.7	1.0
O	31,056[1]	79	580	5.0	492.1	492.1	493.1	1.0
Cottonwood Branch								
A	1,545[2]	100	978	6.9	430.5	430.4[3]	431.4	1.0
B	3,870[2]	454	4,596	1.5	438.5	438.5	439.2	0.7
C	7,645[2]	420	1,353	5.0	452.5	452.5	453.1	0.6
D	13,030[2]	511	2,331	2.7	465.1	465.1	466.1	1.0
E	16,330[2]	90	674	6.5	468.4	468.4	469.1	0.7
F	18,250[2]	300	966	3.2	479.4	479.4	480.3	0.9
G	21,850[2]	300	877	3.5	489.2	489.2	489.9	0.7
H	23,890[2]	327	1,821	1.7	503.6	503.6	504.1	0.5
I	25,880[2]	162	378	6.4	508.3	508.3	508.6	0.3
J	28,050[2]	200	566	3.8	522.2	522.2	523.1	0.9
South Fork of Hackberry Creek								
A	1,640[2]	711	4,747	1.1	445.6	445.6	446.5	0.9
B	2,765[2]	182	1,243	4.7	445.7	445.7	445.7	0.0
C	3,425[2]	158	1,632	3.5	446.5	446.5	446.5	0.0
D	4,900[2]	167	1,674	3.4	446.8	446.8	446.8	0.0
E	6,344[2]	104	550	7.8	460.5	460.5	460.5	0.0

[1]Feet above confluence with Elm Fork of Trinity River
[2]Feet above confluence with Hackberry Creek
[3]Elevation computed without consideration of backwater from Elm Fork of Trinity River

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOODWAY DATA

HACKBERRY CREEK - COTTONWOOD BRANCH - SOUTH FORK OF HACKBERRY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Fork of Hackberry Creek (continued)								
F	10,420[1]	227	1,055	4.1	476.7	476.7	477.7	1.0
G	15,685[1]	147	629	2.5	496.7	496.7	497.4	0.7
Mud Springs Creek								
A	1,305[1]	258	1,756	4.6	475.9	475.9	476.9	1.0
B	1,845[1]	242	1,854	4.3	477.9	477.9	478.9	1.0
Grapevine Creek								
A	8,500[2]	300/70[3]	1,778	5.5	439.6	438.5[4]	438.5	0.0
B*	14,170[2]	470/270[3]	2,079	5.3	453.0	453.0	453.8	0.8
K	42,170[2]	1,010	5,117	1.5	532.0	532.0	533.0	1.0
L	47,450[2]	420	1,833	4.2	543.3	543.3	544.1	0.8
M	48,350[2]	240	1,787	4.4	544.6	544.6	545.5	0.9

[1]Feet above confluence with Hackberry Creek
[2]Feet above confluence with Elm Fork of Trinity River
[3]Width/width within corporate limits

*Cross section C through J located outside corporate limits ; not shown on maps
[4]Elevation computed without consideration of flooding from Elm Fork of Trinity River

TABLE 2

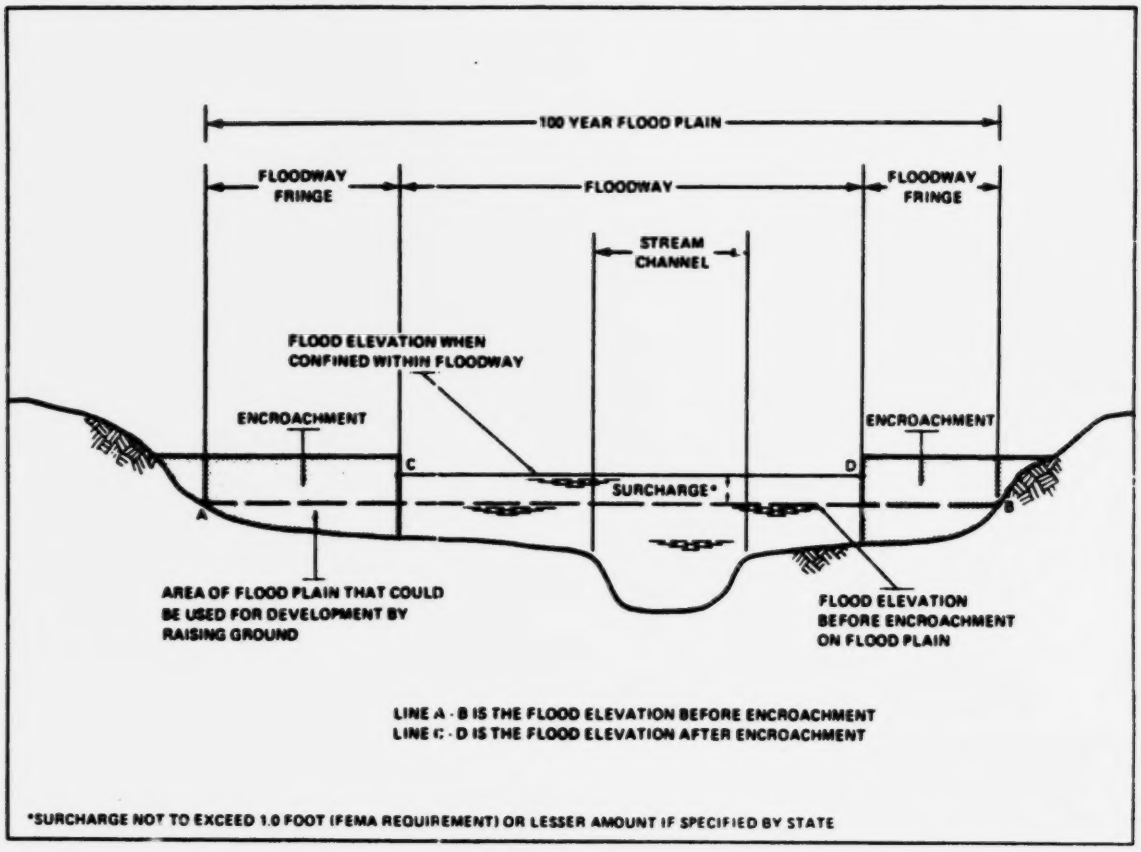
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOODWAY DATA

SOUTH FORK OF HACKBERRY CREEK - MUD SPRINGS CREEK - GRAPEVINE CREEK

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE

FLOODWAY SCHEMATIC

Figure 2

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 3 for certain downstream cross sections of the Elm Fork of Trinity River are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail in the City of Irving.

5.1 Reach Determinations

Reaches are defined as sections of floodplain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the City of Irving is shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one- half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
West Fork of Trinity River							
Reach 1	40,45,50	-5.3	-1.4	+5.3	055	A11	Varies
Reach 2	45	-3.7	-0.7	+1.7	035	A7	Varies
Reach 3	45	-5.8	-2.3	+2.0	060	A12	Varies
Elm Fork of Trinity River							
Reach 1	20,25,40, 50	-2.7	-0.8	+3.8	025	A5	Varies
Reach 2	20,25	-3.4	-0.9	+2.2	035	A7	Varies
Reach 3	10,20,25	-3.8	-1.2	+2.6	040	A8	Varies
Bear Creek							
Reach 1	45	-0.9	-0.3	+0.3	010	A2	Varies
Reach 2	45	-2.8	-0.7	+0.9	030	A6	Varies
Reach 3	30	-6.6	-2.4	+4.3	065	A13	Varies
Reach 4	30	-2.8	-1.1	+2.5	030	A6	Varies
Dry Creek							
Reach 1	30,35,45	-1.3	-0.4	+0.7	015	A3	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOOD INSURANCE ZONE DATA

WEST FORK OF TRINITY RIVER - ELM FORK OF TRINITY RIVER - BEAR CREEK - DRY CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Estelle Creek							
Reach 1	30	-2.1	-0.6	+1.5	020	A4	Varies
Reach 2	30	-0.7	-0.3	+0.3	005	A1	Varies
Delaware Creek							
Reach 1	45,50	-0.8	-0.2	+0.5	010	A2	Varies
Reach 2	35,45	-2.0	-0.5	+1.0	020	A4	Varies
Reach 3	35	-0.8	-0.2	+0.4	010	A2	Varies
West Irving Branch							
Reach 1	45	-0.9	-0.3	+0.7	010	A2	Varies
Reach 2	45	-2.2	-0.7	+0.9	020	A4	Varies
Reach 3	35,45	-1.3	-0.3	+0.7	015	A3	Varies
Reach 4	35	-2.0	-0.3	+1.4	020	A4	Varies
Reach 5	35	-0.5	-0.2	+0.2	005	A1	Varies
Stream 7C2							
Reach 1	40	-1.0	-0.3	+0.6	010	A2	Varies
Reach 2	40	-2.5	-0.9	+1.1	025	A5	Varies
Reach 3	40	-1.1	-0.3	+1.2	010	A2	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOOD INSURANCE ZONE DATA

ESTELLE CREEK - DELAWARE CREEK - WEST IRVING BRANCH - STREAM 7C2

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Hackberry Creek							
Reach 1	20	-2.1	-0.6	+1.0	020	A4	Varies
Reach 2	20	-2.3	-0.7	+1.2	025	A5	Varies
Reach 3	15,20	-1.2	-0.4	+0.8	010	A2	Varies
Cottonwood Branch							
Reach 1	20,35	-2.5	-0.7	+1.0	025	A5	Varies
Reach 2	35	-0.8	-0.2	+0.5	010	A2	Varies
South Fork of Hackberry Creek							
Reach 1	20	-2.9	-0.8	+0.8	030	A6	Varies
Reach 2	20	-2.0	-0.7	+1.1	020	A4	Varies
Reach 3	20	-1.0	-0.3	+0.5	010	A2	Varies
Reach 4	20	-2.0	-0.6	+0.7	020	A4	Varies
Reach 5	15,20	-0.7	-0.2	+0.4	010	A1	Varies
Mud Springs Creek							
Reach 1	20	-1.2	-0.3	+0.7	010	A2	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOOD INSURANCE ZONE DATA

HACKBERRY CREEK · COTTONWOOD BRANCH · SOUTH FORK OF HACKBERRY CREEK · MUD SPRINGS CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Grapevine Creek							
Reach 1	10	-1.9	-0.5	+1.2	020	A4	Varies
Reach 2	10	-1.6	-0.4	+1.2	015	A3	Varies
Reach 3	05,15	-1.9	-0.5	+1.0	020	A4	Varies
Reach 4	15	-0.7	-0.2	+0.4	005	A1	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOOD INSURANCE ZONE DATA

GRAPEVINE CREEK

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zones A1, A2, A3, A4, A5, A6, A7, A11, A12, and A13:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Irving is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

The COE has published the following reports that contain data related to the flood situation in Irving: Flood Plain Information, Delaware Creek, Irving, Texas (Reference 3); Flood Plain Information, Bear Creek, Dallas and Tarrant Counties, Texas (Reference 11); Flood Plain Information, Hackberry Creek and Cottonwood Branch, Dallas County, Texas (Reference 12); Special Flood Hazard Information Report, Elm Fork of Trinity River, Dallas, Texas (Reference 13); and Preliminary Flood Control Investigation of Delaware Creek, Three Tributaries, and West Irving Branch, Irving, Texas (Reference 14). The profiles used in these reports differ from

those in this study for the City of Irving in some reaches due primarily to the differences in watershed and stream conditions, new bridges, channels, and floodplain development. Also, more detailed field data were collected, there are differences in discharges, and different hydraulic modeling techniques were used. Since all of these studies were made by the COE, reconciliation of these differences was made within the agency.

Flood Insurance Studies have been prepared for the Cities of Grand Prairie and Grapevine, and the unincorporated areas of Dallas County (References 15, 16, and 17). The results of those studies are in complete agreement with the results of this study.

Flood Insurance Studies for the Cities of Carrollton, Coppell, Farmers Branch, and Dallas are currently being revised based on the updated hydrologic and hydraulic analyses on the Elm Fork of Trinity River (References 18, 19, 20, and 21). The results of those studies will be in exact agreement with the results of this study.

Flood Insurance Studies for the City of Euless and the unincorporated areas of Tarrant County are currently being prepared (References 22 and 23). The results of those studies will be in exact agreement with this study.

This Flood Insurance Study supersedes the previously effective study for the City of Irving (Reference 10).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting FEMA, the Natural and Technological Hazards Division, Federal Regional Center, 800 North Loop 288, Denton, Texas 76201.

8.0 BIBLIOGRAPHY AND REFERENCES

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2. U. S. Army Corps of Engineers, Flood Plain Information Report, West Fork of Trinity River, Fort Worth to Dallas County Line, Fort Worth, Texas, April 1963.

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15. Federal Emergency Management Agency, Flood Insurance Study, City of Grand Prairie, Dallas and Tarrant Counties, Texas, Washington, D. C., September 4, 1986.

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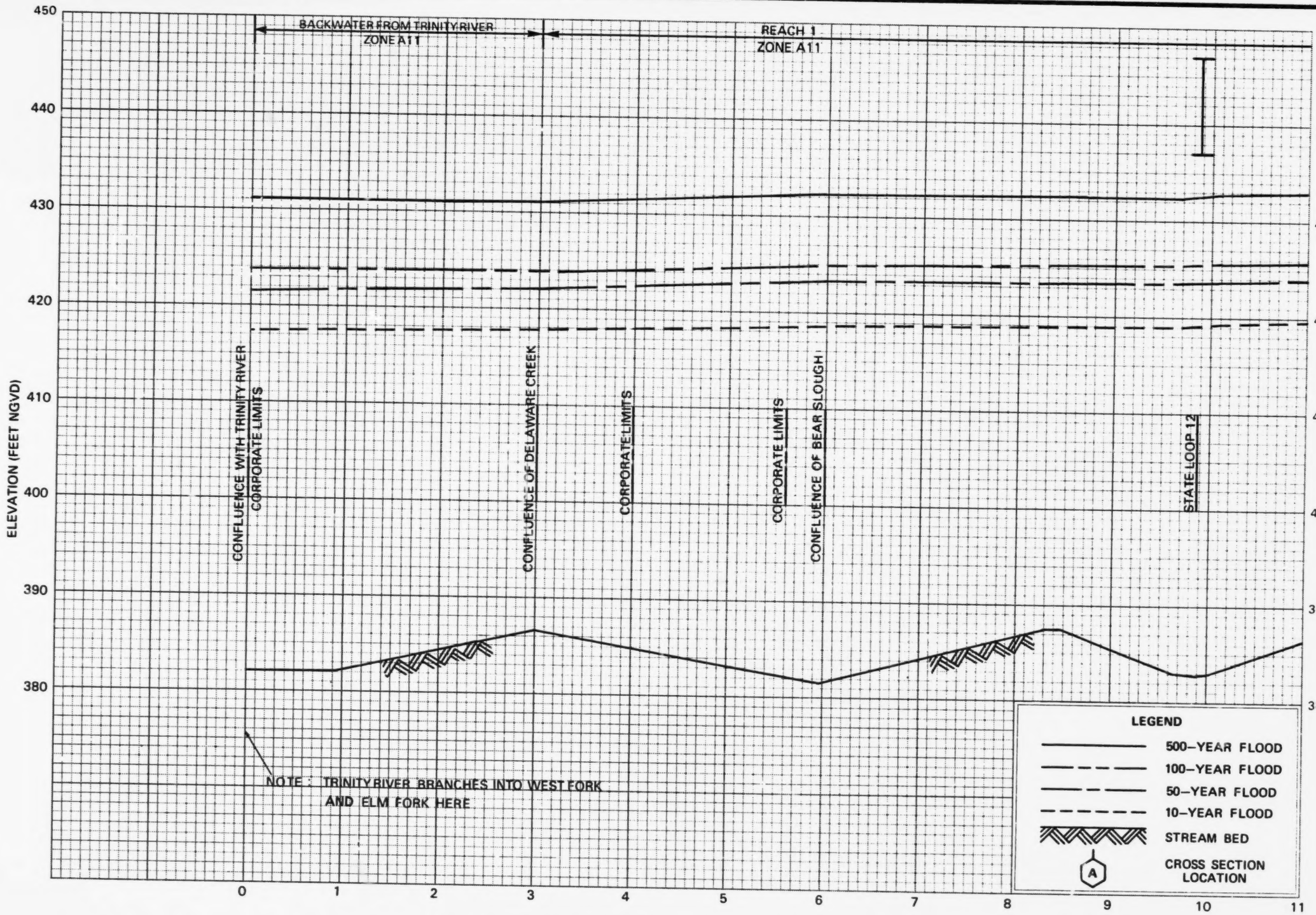


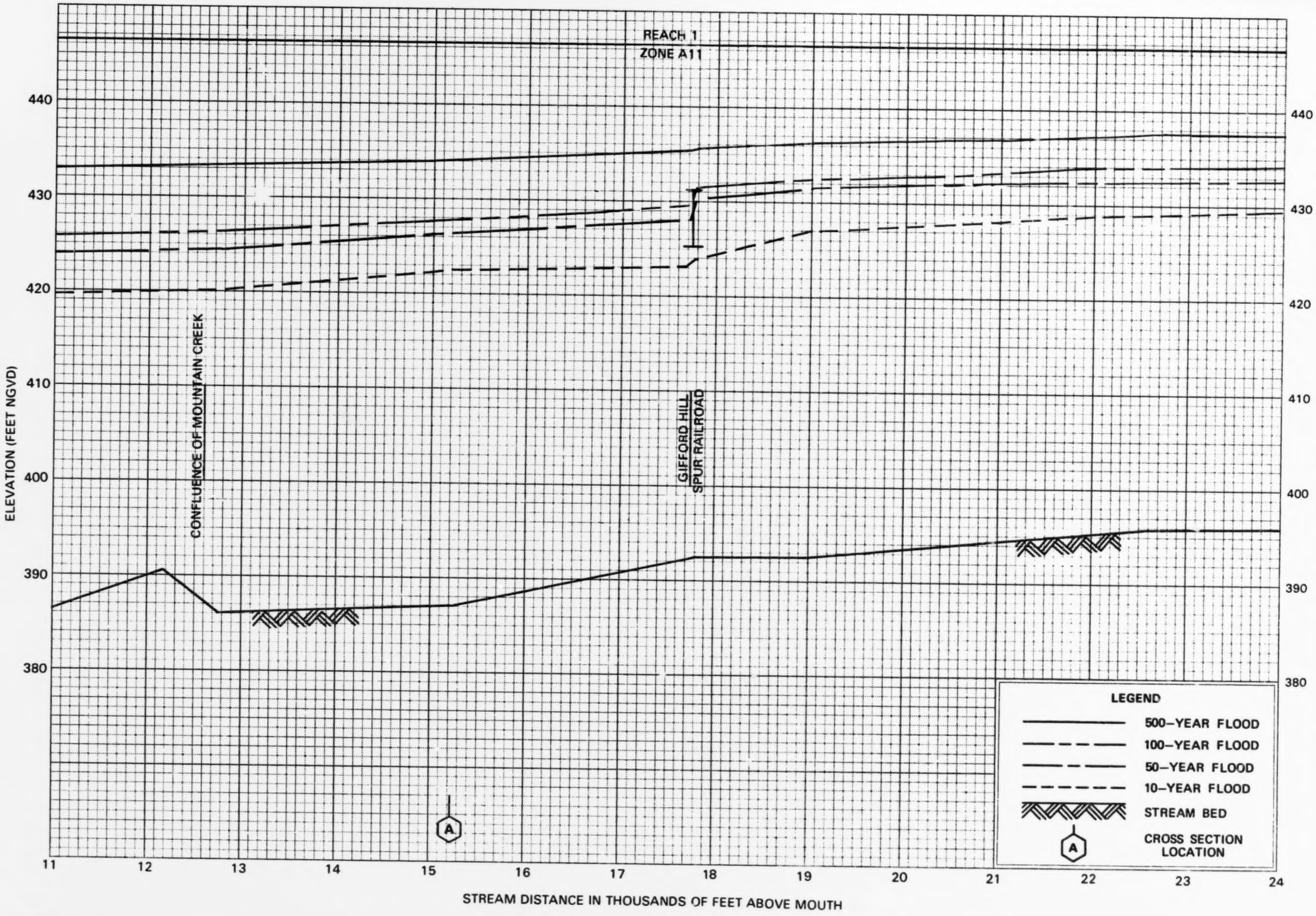
FLOOD PROFILES

WEST FORK OF TRINITY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

01P



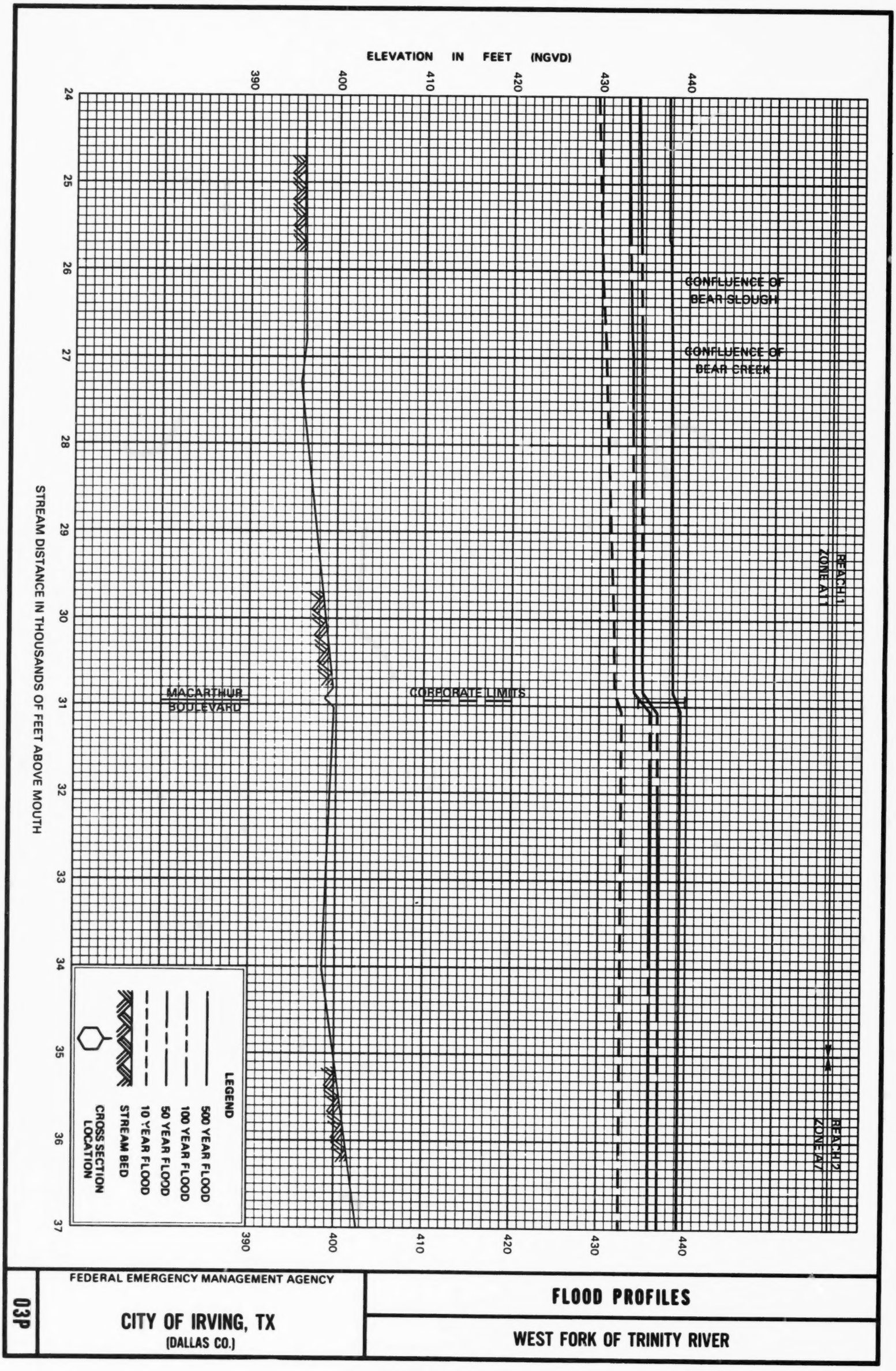
FLOOD PROFILES

WEST FORK OF TRINITY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

02P



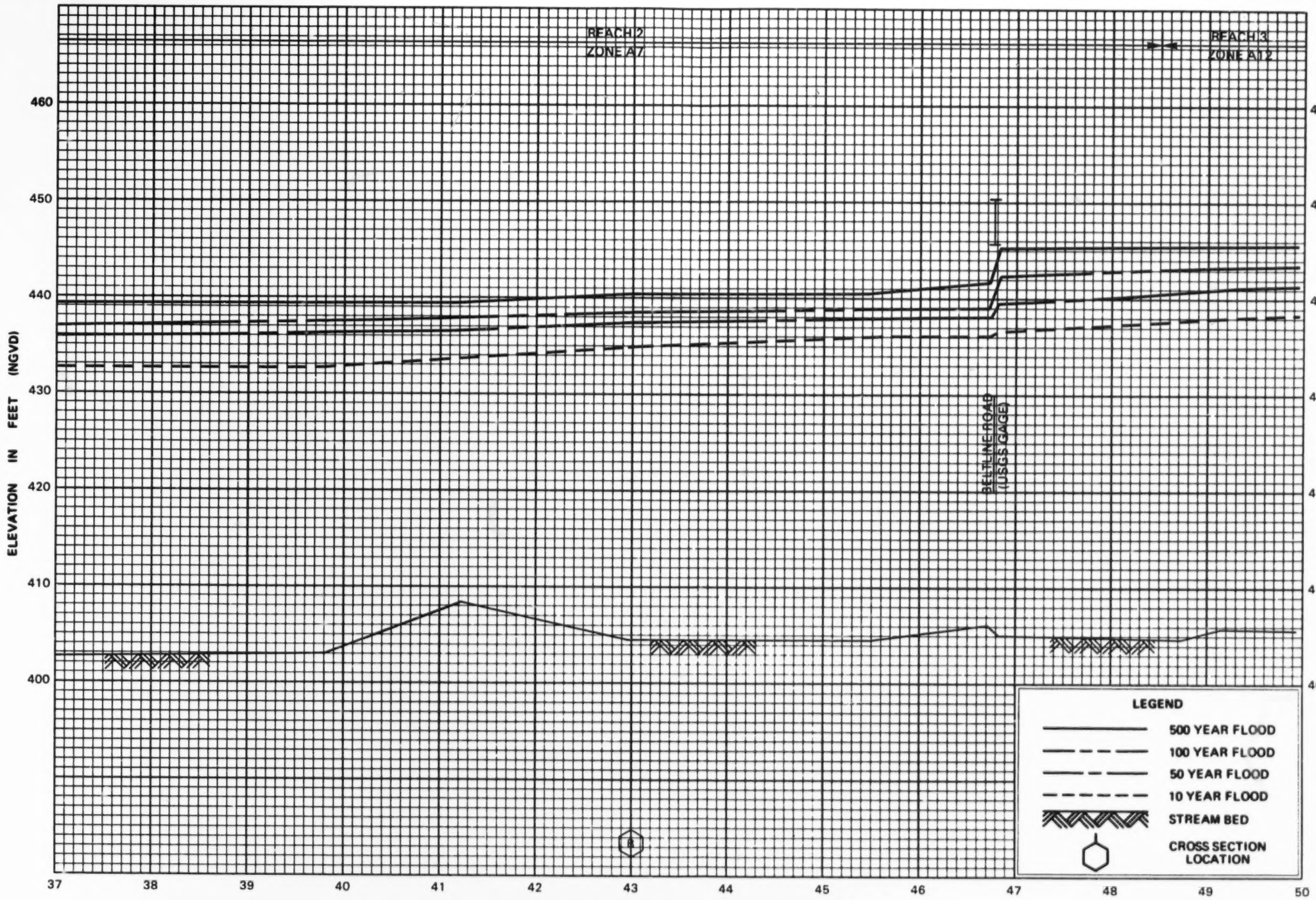
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOOD PROFILES

WEST FORK OF TRINITY RIVER

03P



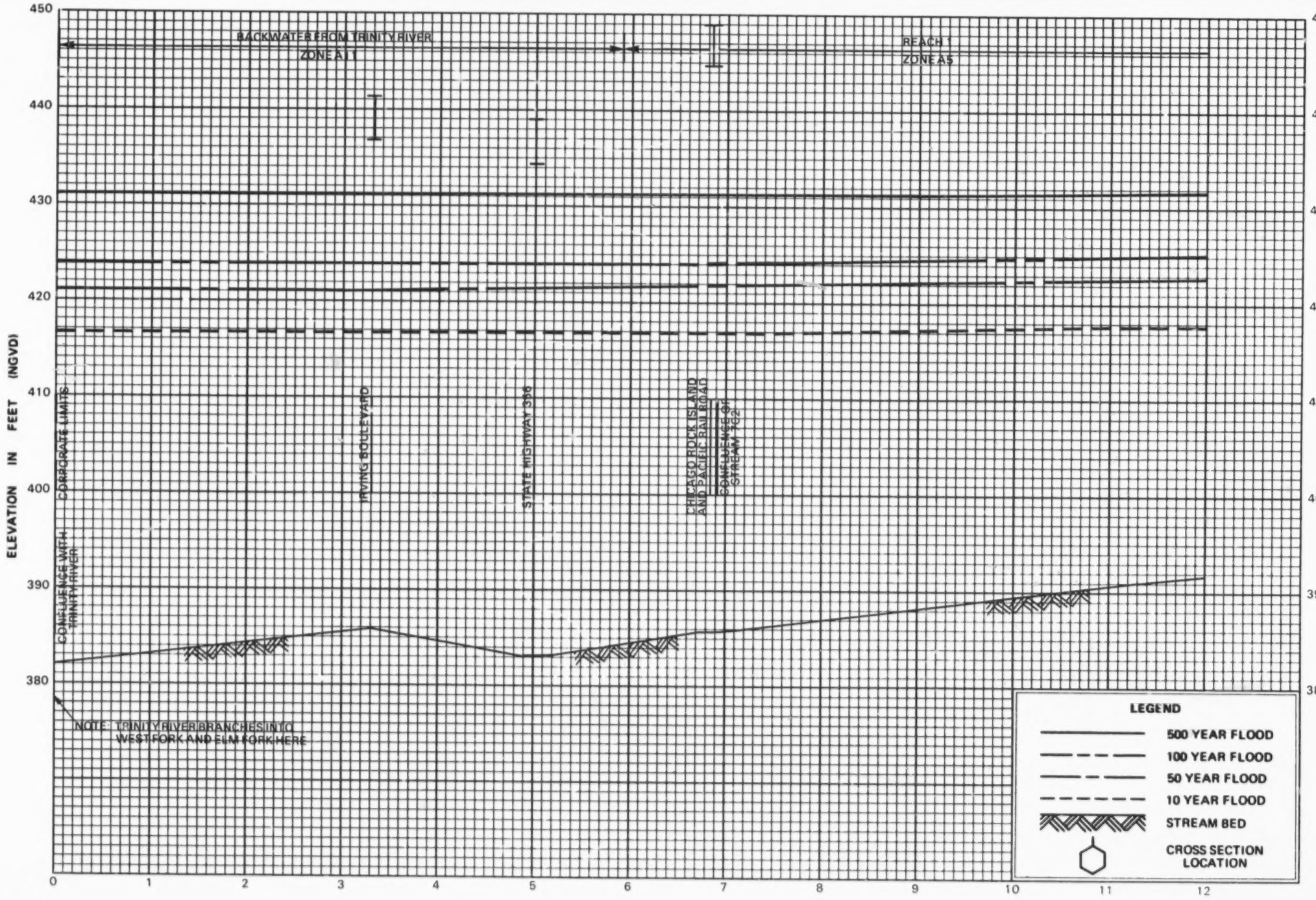
FLOOD PROFILES

WEST FORK OF TRINITY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

04P



FLOOD PROFILES

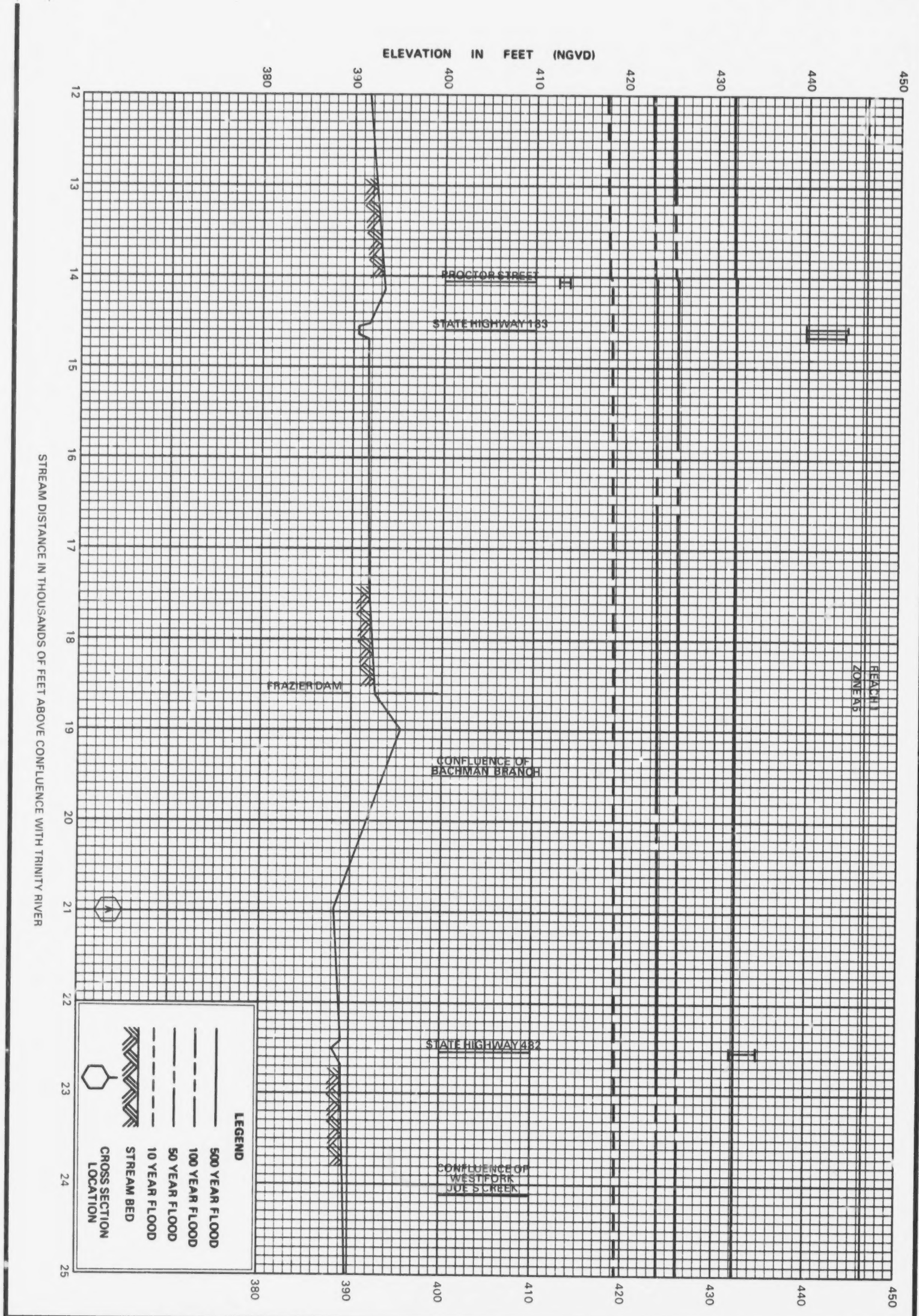
ELM FORK OF TRINITY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX

(DALLAS CO.)

05P



FEDERAL EMERGENCY MANAGEMENT AGENCY

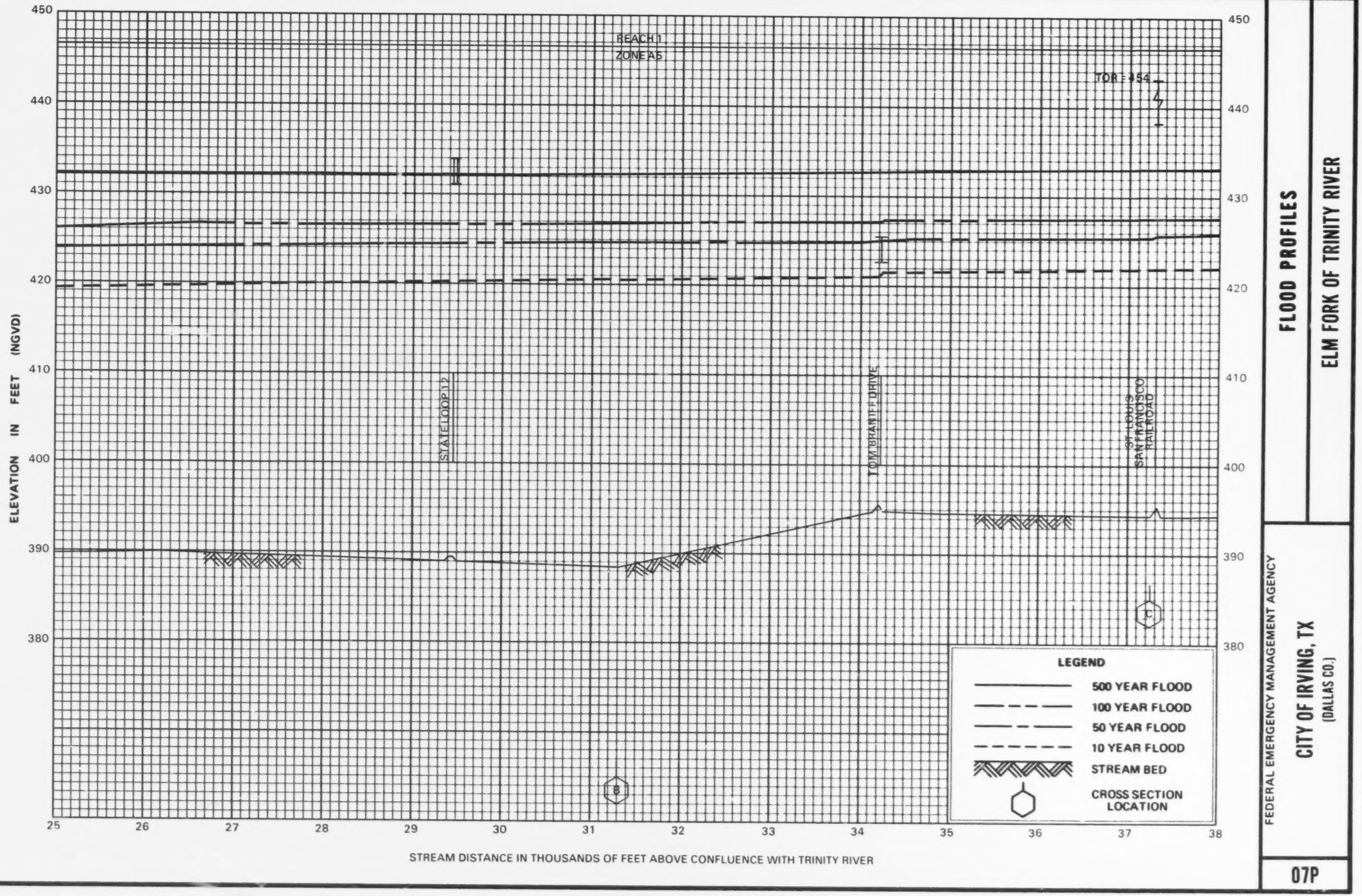
CITY OF IRVING, TX

(DALLAS CO.)

FLOOD PROFILES

ELM FORK OF TRINITY RIVER

06P



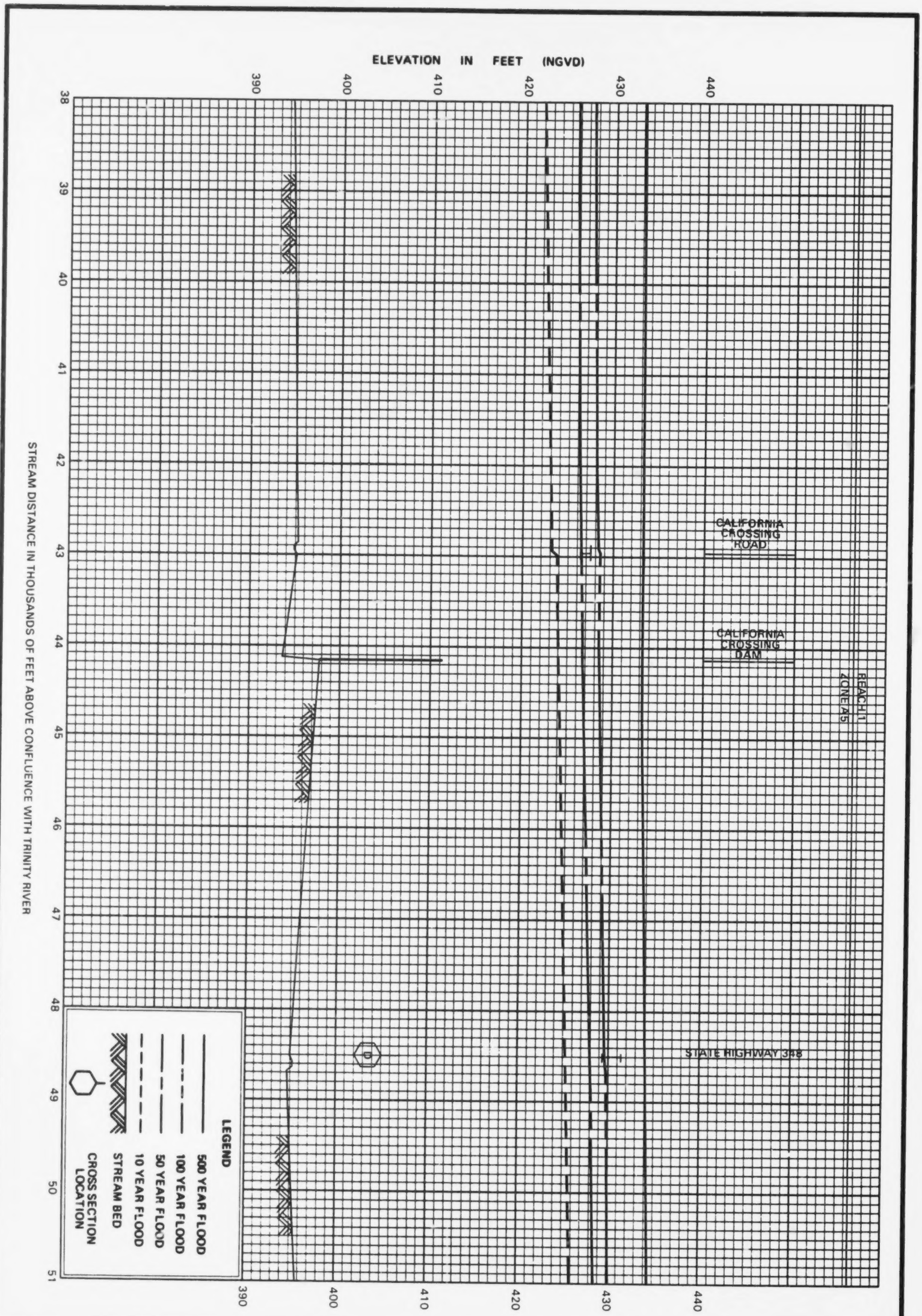
FLOOD PROFILES

ELM FORK OF TRINITY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

07P



08P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOOD PROFILES

ELM FORK OF TRINITY RIVER

REACH 1
ZONE A5

REACH 2
ZONE A7

CONFLUENCE OF HACKBERRY CREEK

ROYAL LANE

CORPORATE LIMITS

CONFLUENCE OF FARMERS BRANCH/ RATHIDE CREEK

CORPORATE LIMITS

ELEVATION IN FEET (NGVD)

440
430
420
410
400
390

51 52 53 54 55 56 57 58 59 60 61 62 63 64

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE CONFLUENCE WITH TRINITY RIVER

E F G H

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

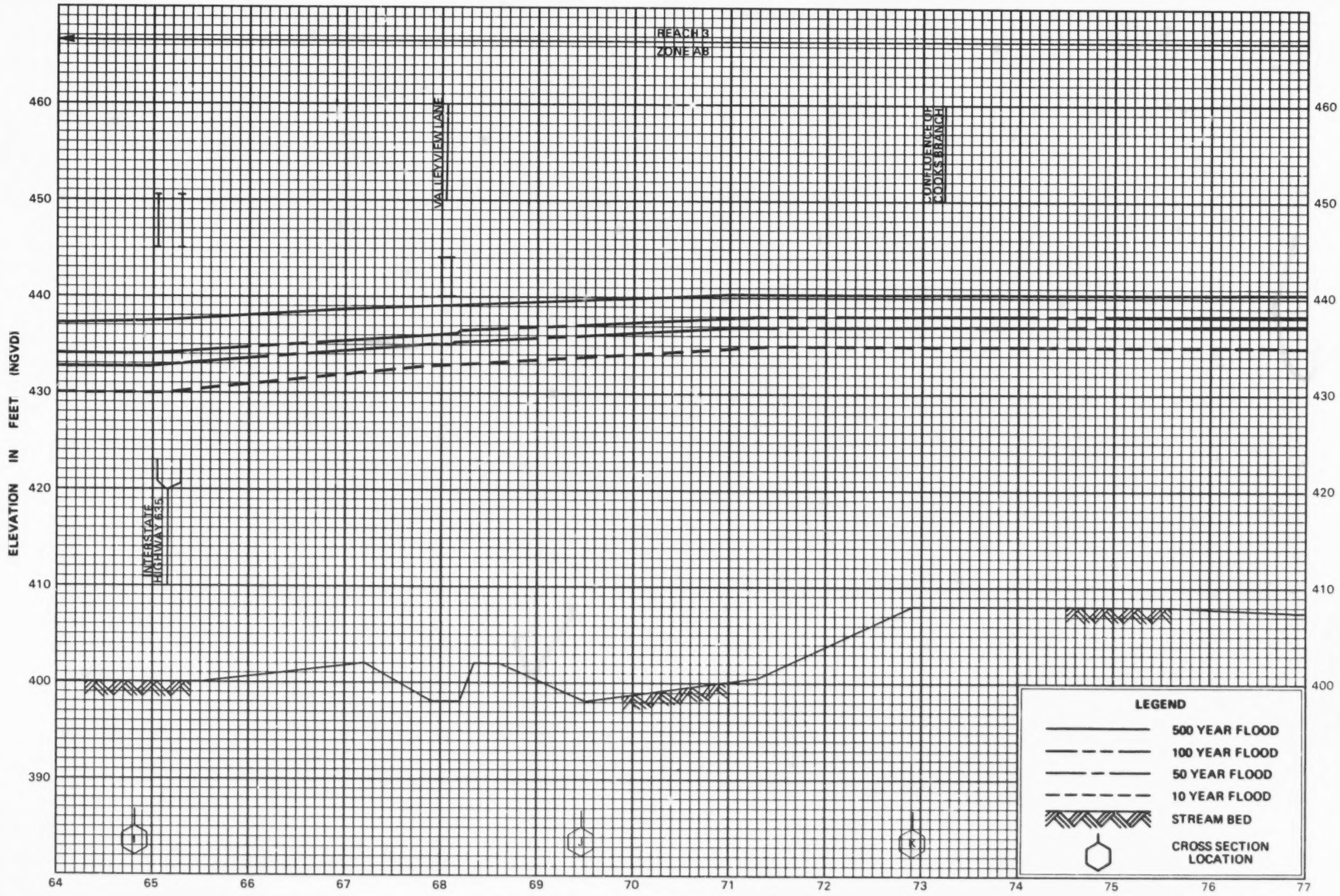
FLOOD PROFILES

ELM FORK OF TRINITY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

09P



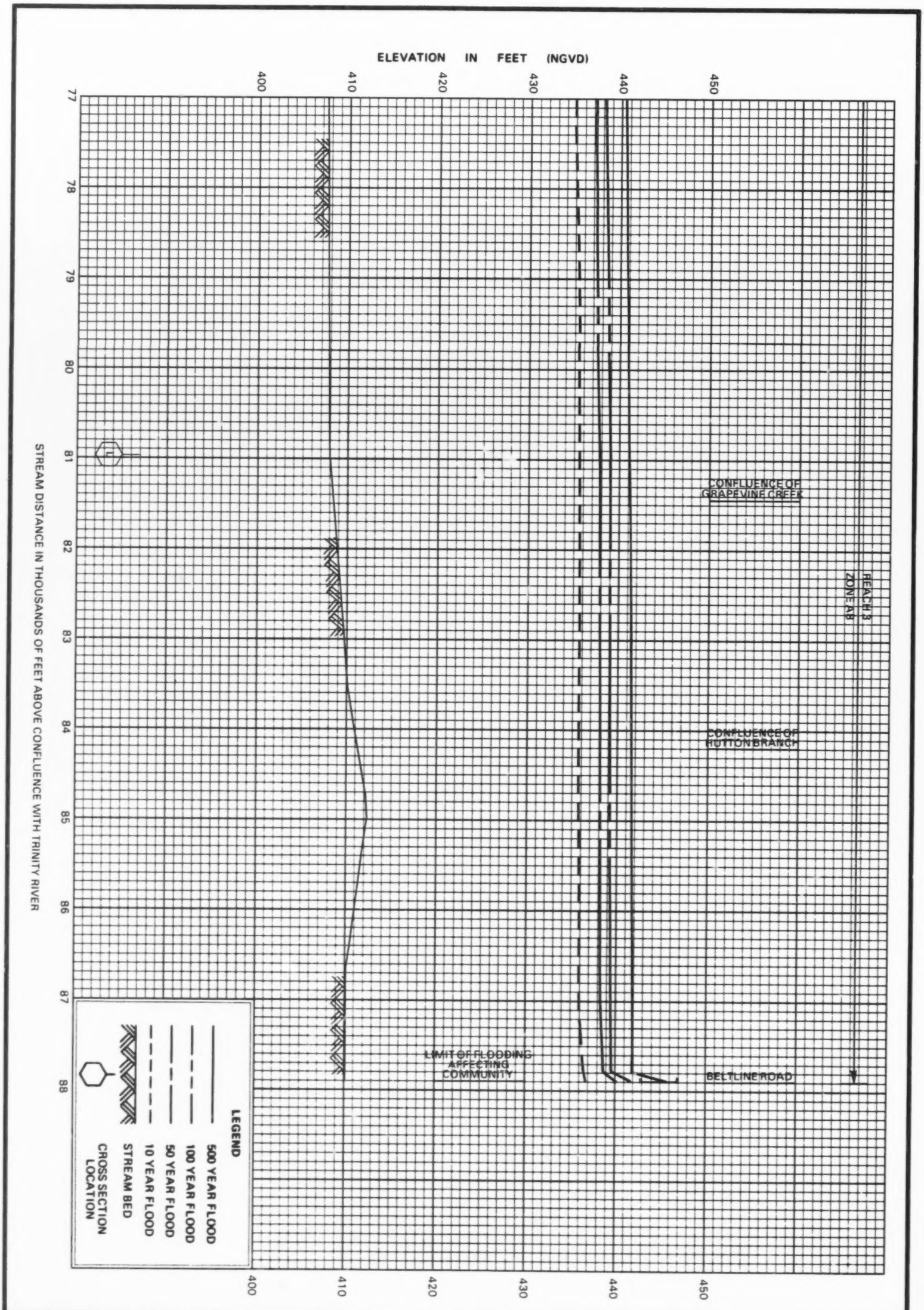
FLOOD PROFILES

ELM FORK OF TRINITY RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

10P



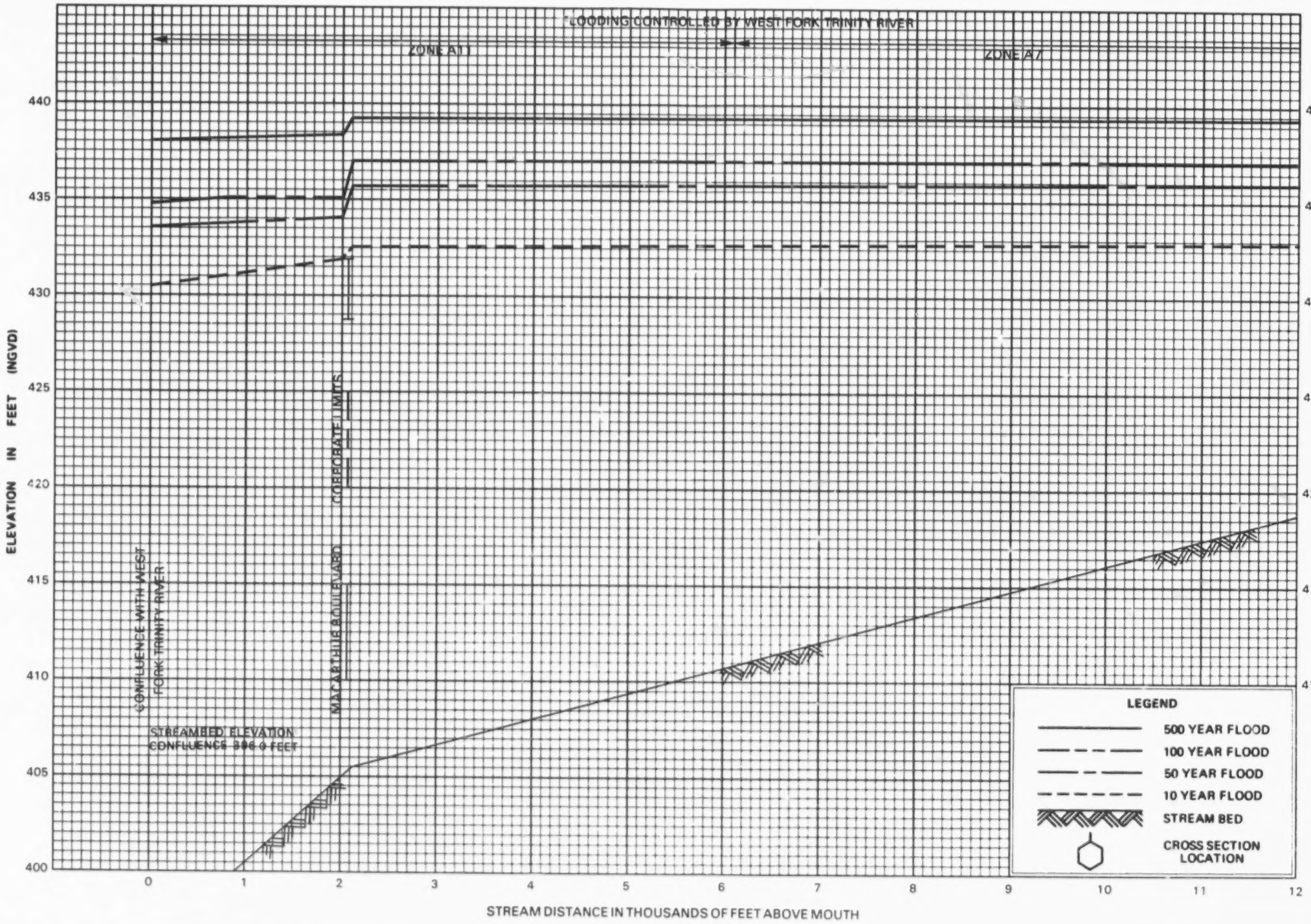
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOOD PROFILES

ELM FORK OF TRINITY RIVER

11P



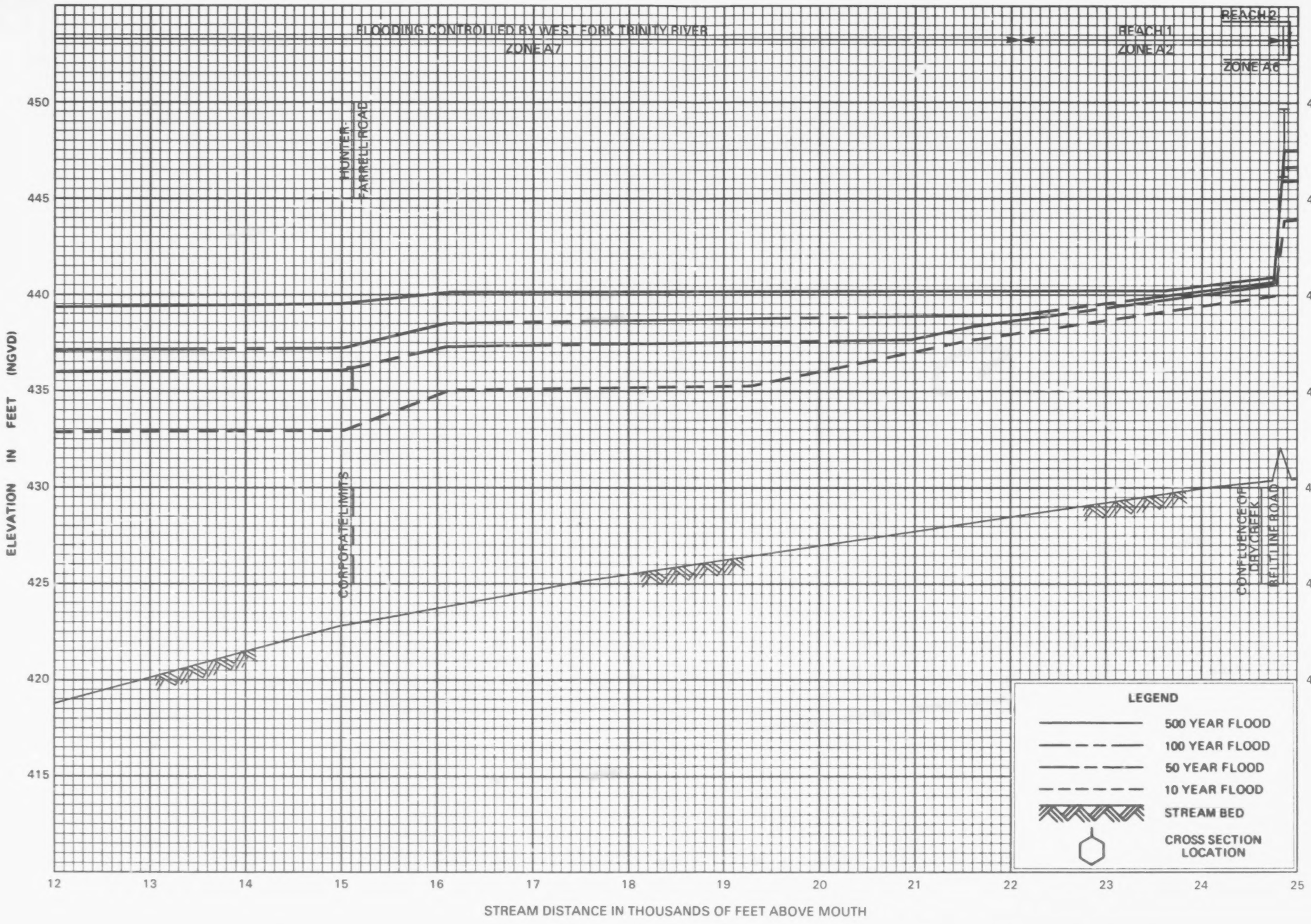
FLOOD PROFILES

BEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

12P



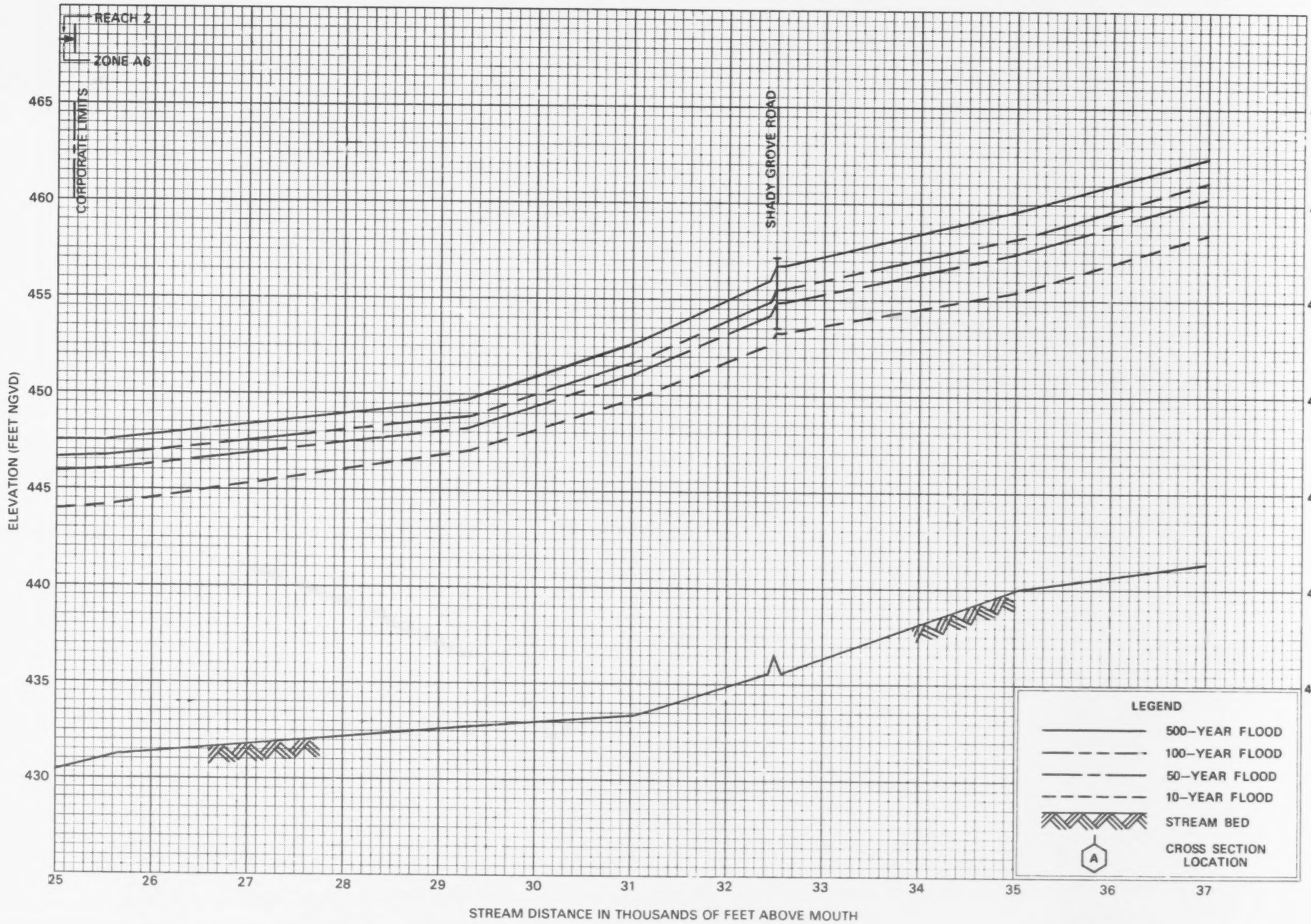
FLOOD PROFILES

BEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

13P



FLOOD PROFILES

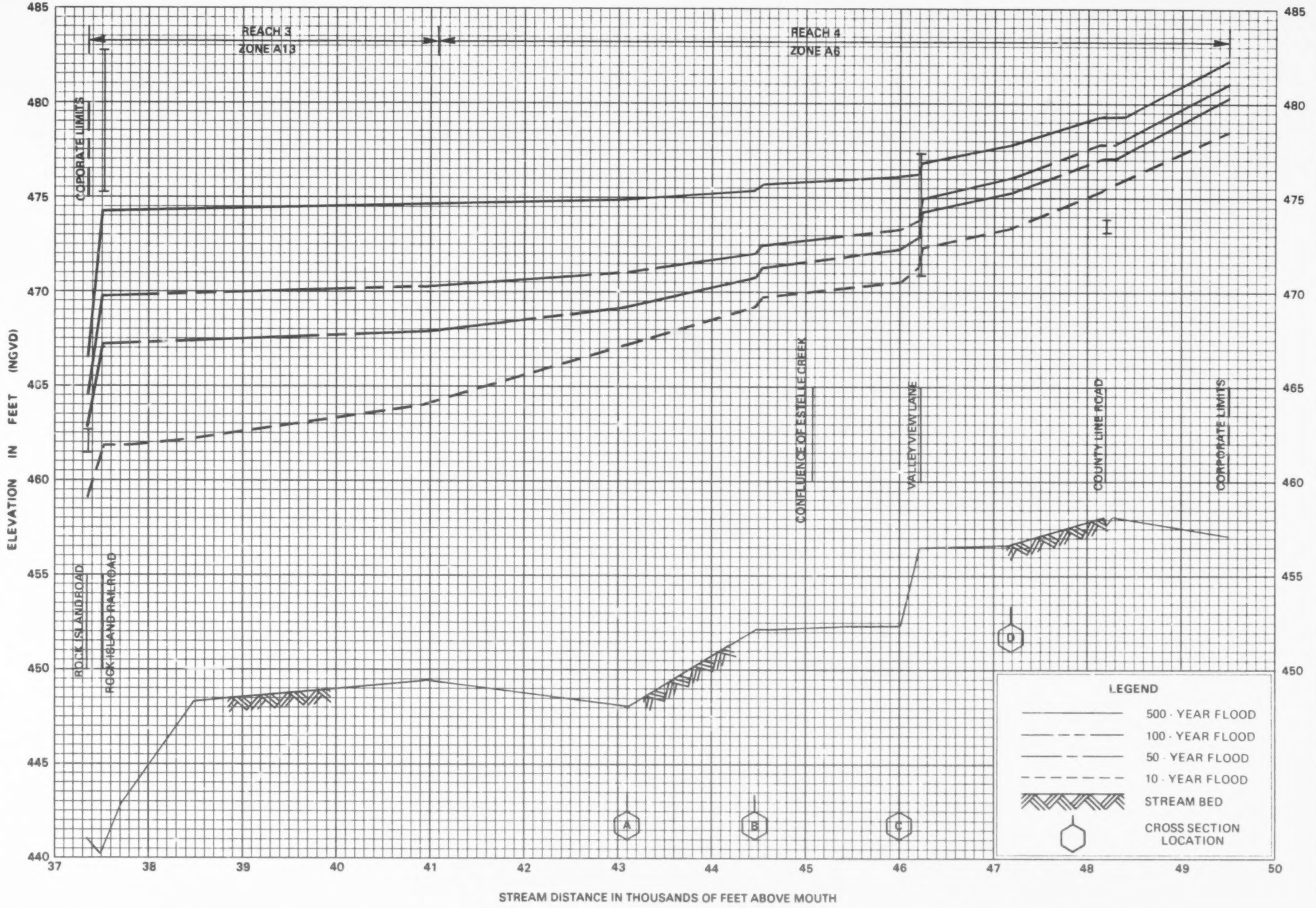
BEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX

(DALLAS CO.)

14P



FLOOD PROFILES

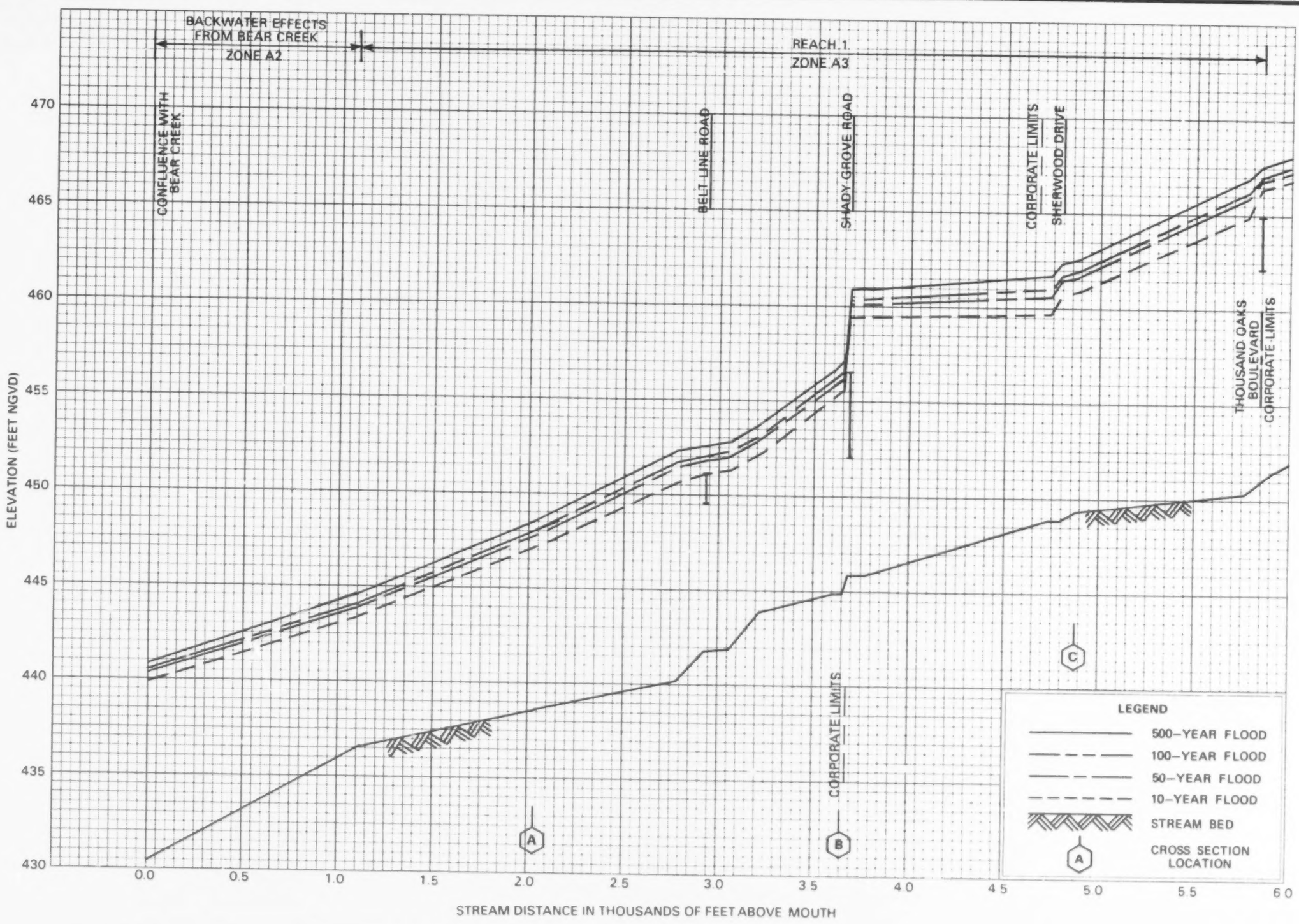
BEAR CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

15P

45



FLOOD PROFILES

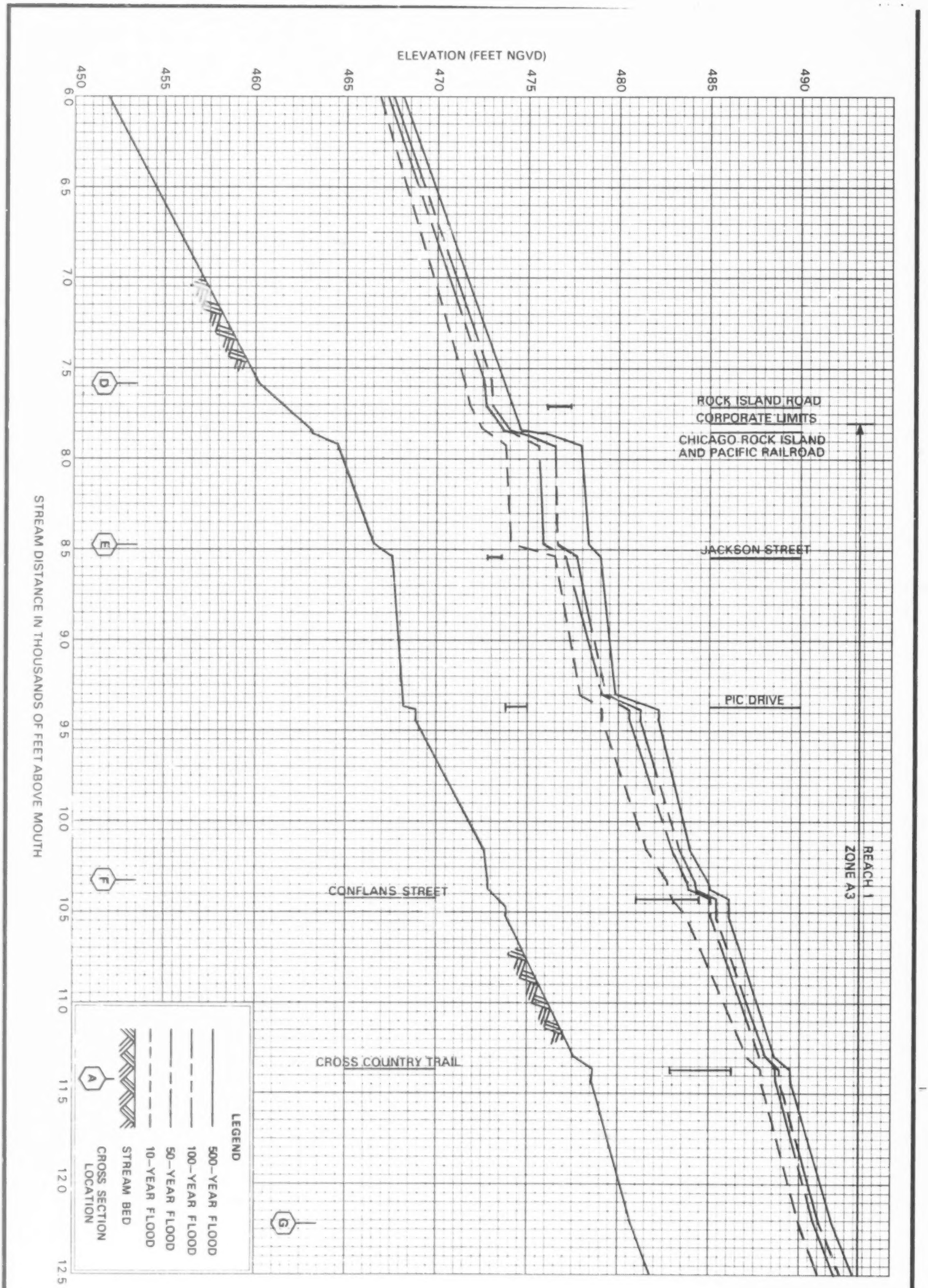
DRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

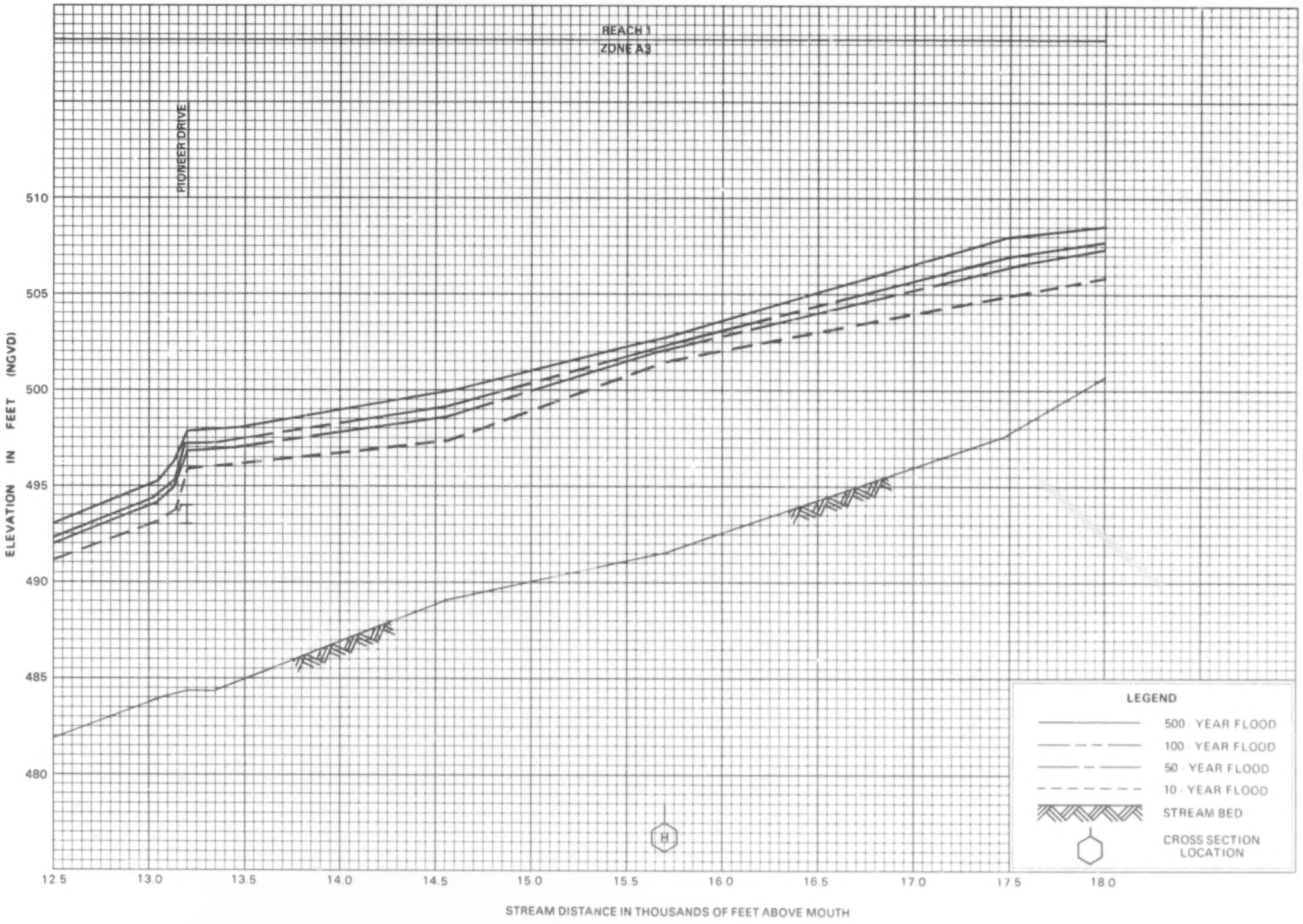
CITY OF IRVING, TX

(DALLAS CO.)

16P



17P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF IRVING, TX (DALLAS CO.)	FLOOD PROFILES DRY CREEK



FLOOD PROFILES

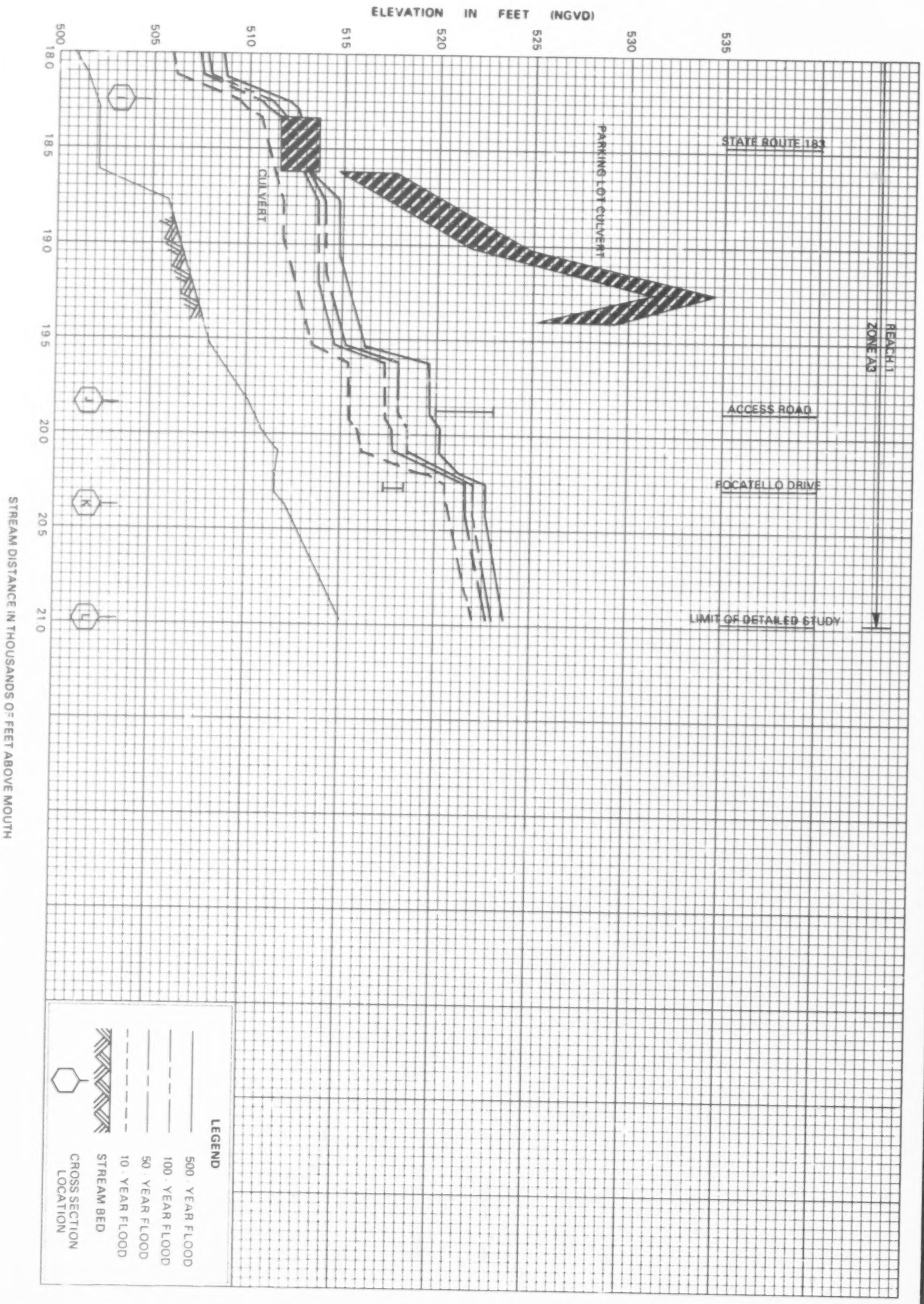
DRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

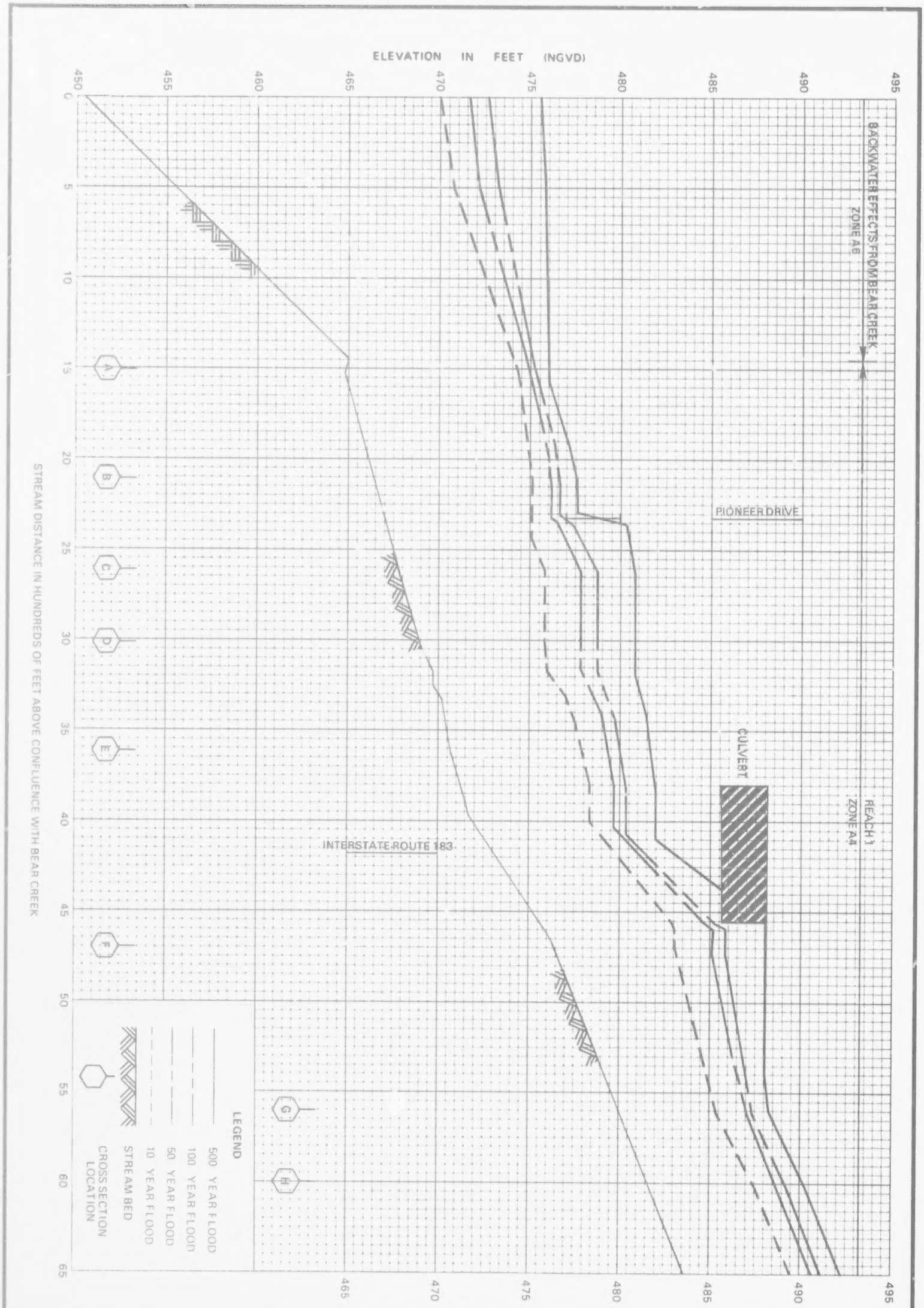
CITY OF IRVING, TX

(DALLAS CO.)

18P



19P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF IRVING, TX (DALLAS CO.)	FLOOD PROFILES DRY CREEK



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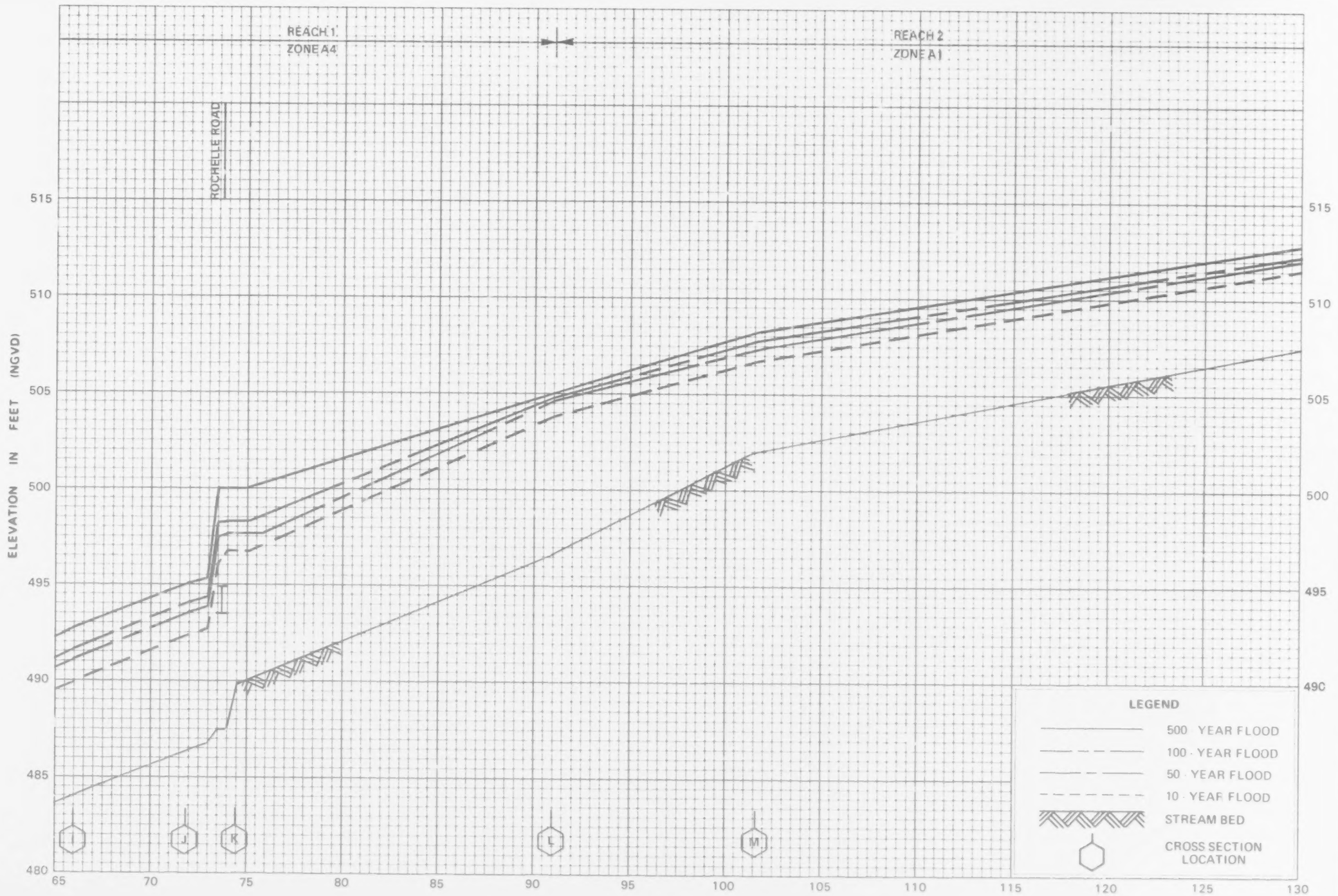
20P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF IRVING, TX (DALLAS CO.)	FLOOD PROFILES ESTELLE CREEK



FLOOD PROFILES

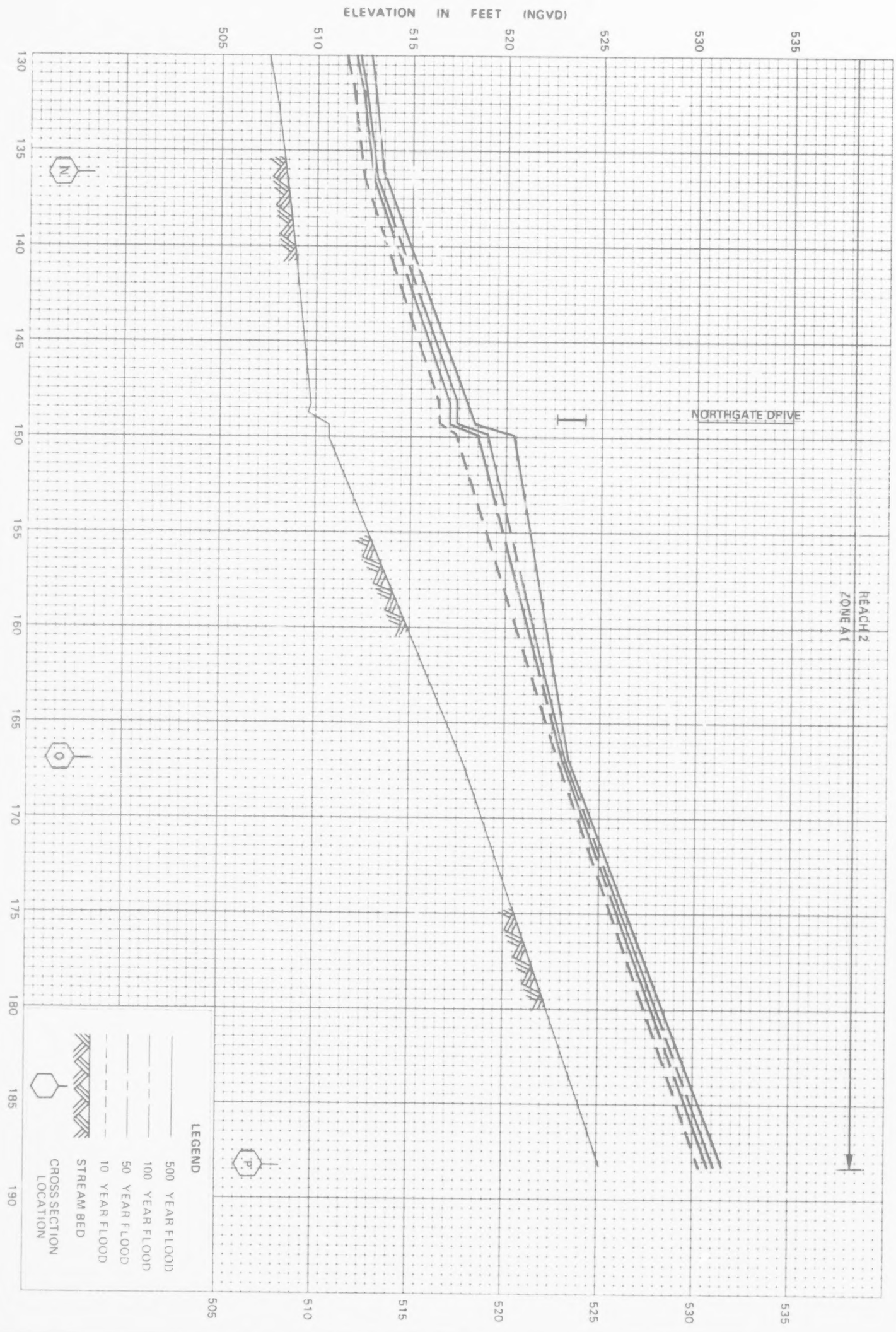
ESTELLE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX

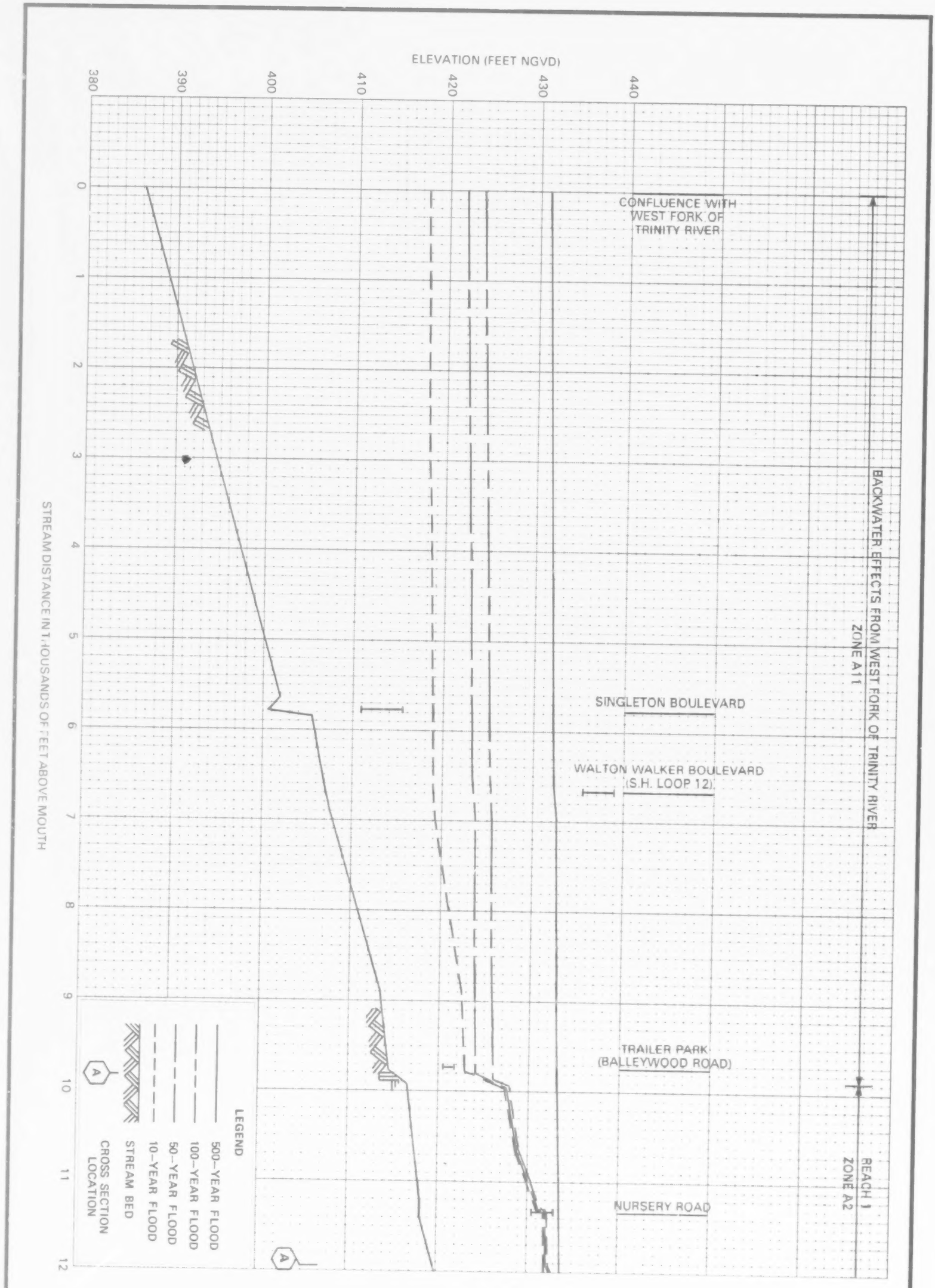
(DALLAS CO.)

21P



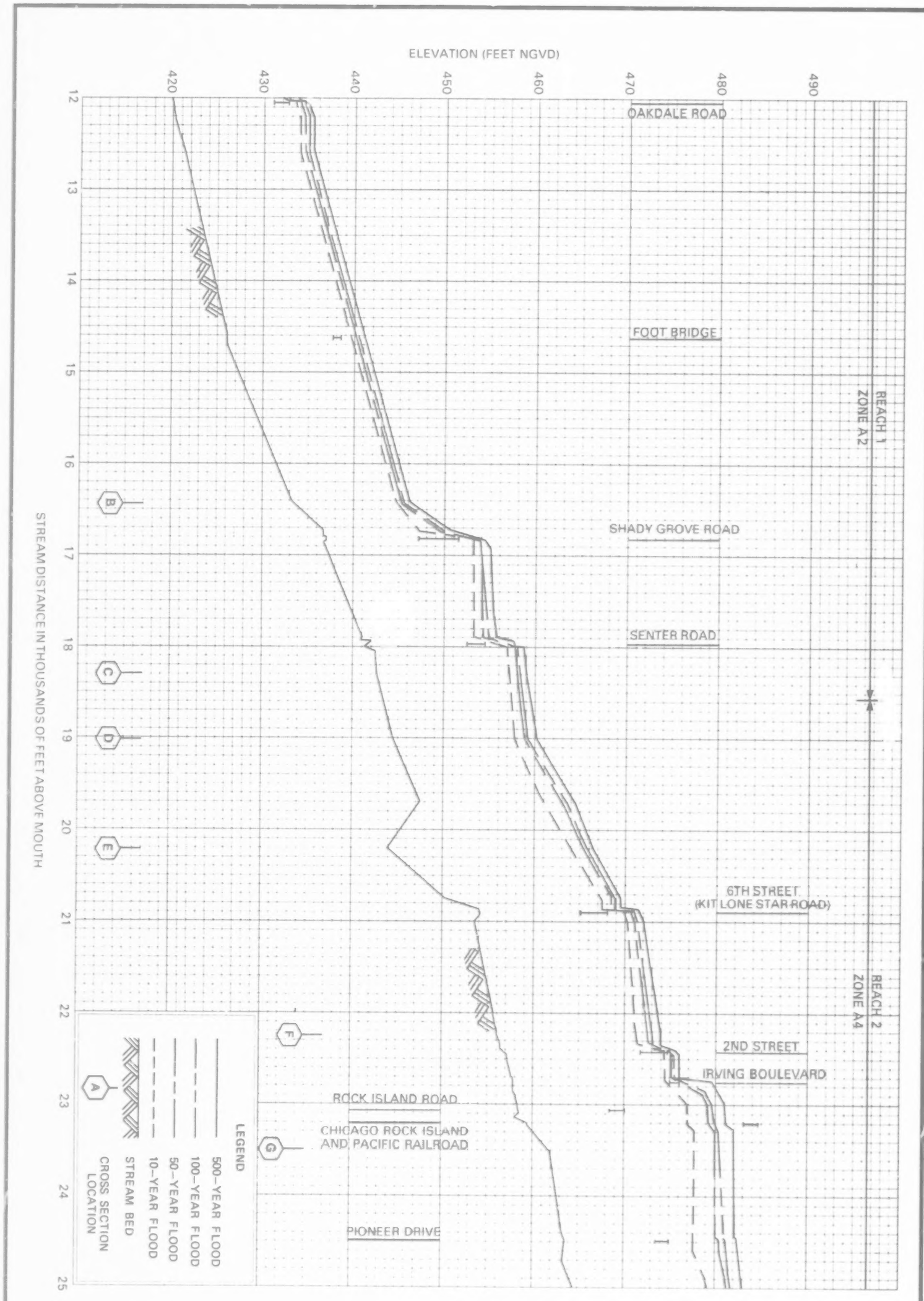
52

22P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF IRVING, TX (DALLAS CO.)	FLOOD PROFILES ESTELLE CREEK



S3

23P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF IRVING, TX (DALLAS CO.)	FLOOD PROFILES DELAWARE CREEK



24P	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF IRVING, TX (DALLAS CO.)	FLOOD PROFILES DELAWARE CREEK

REACH 2
ZONE A4

REACH 3
ZONE A2

MACARTHUR BOULEVARD
GRAUWYLER ROAD
LIVE OAK DRIVE
CRIPPLE CREEK DRIVE
SUNNYBROOK DRIVE
PRIVATE DRIVE
GREEN OAK DRIVE
OAKMEADOW DRIVE
WM. BREWSTER DRIVE
PURITAN DRIVE
U.S. 183
STORY ROAD
LIMIT OF DETAILED STUDY

ELEVATION (FEET NGVD)

530
520
510
500
490
480
470
460

25 26 27 28 29 30 31 32 33 34 35 36 37

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE MOUTH

H I J K L M N

LEGEND

- 500-YEAR FLOOD
- 100-YEAR FLOOD
- 50-YEAR FLOOD
- 10-YEAR FLOOD
- STREAM BED
- A — CROSS SECTION LOCATION

FLOOD PROFILES

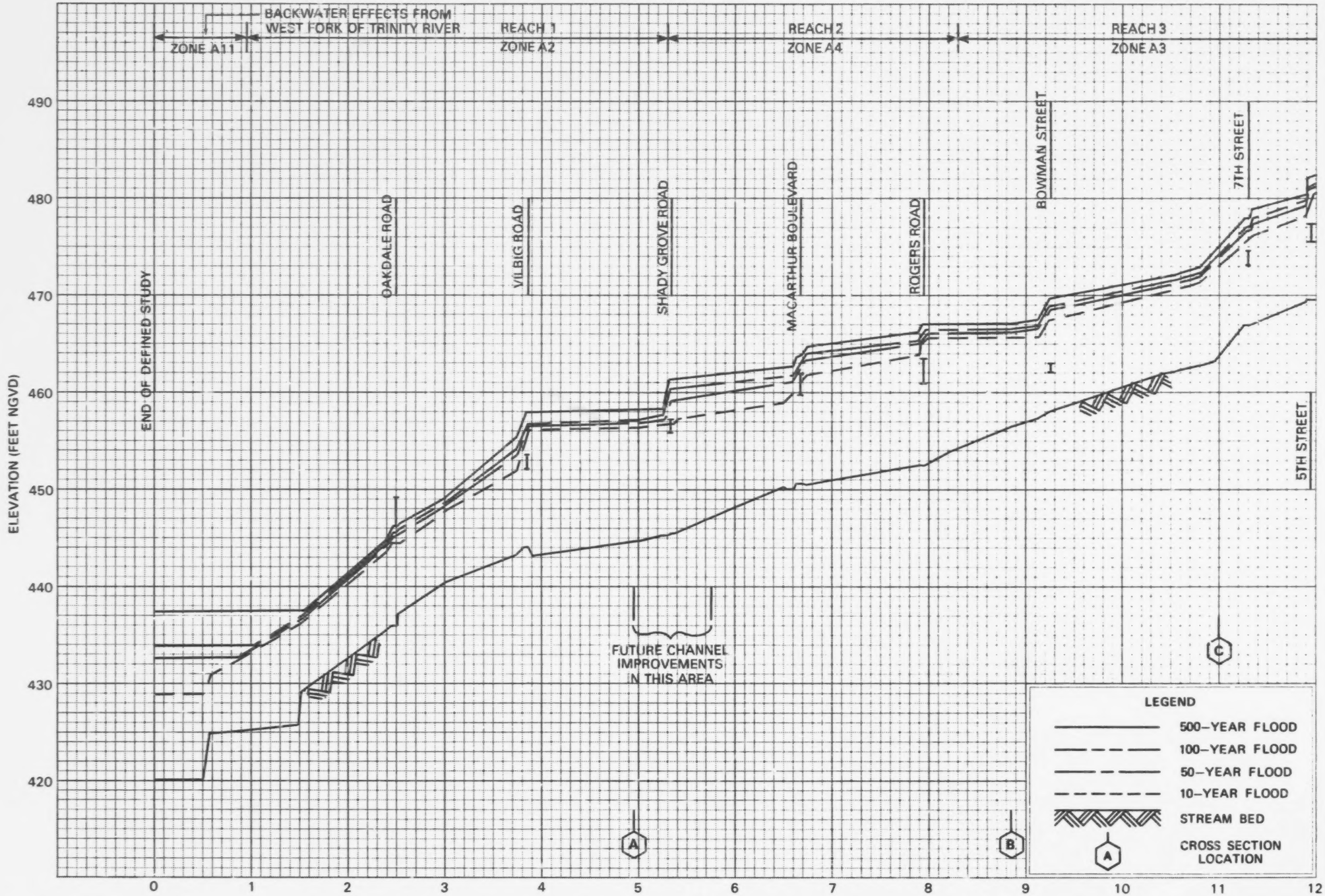
DELAWARE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

25P

55



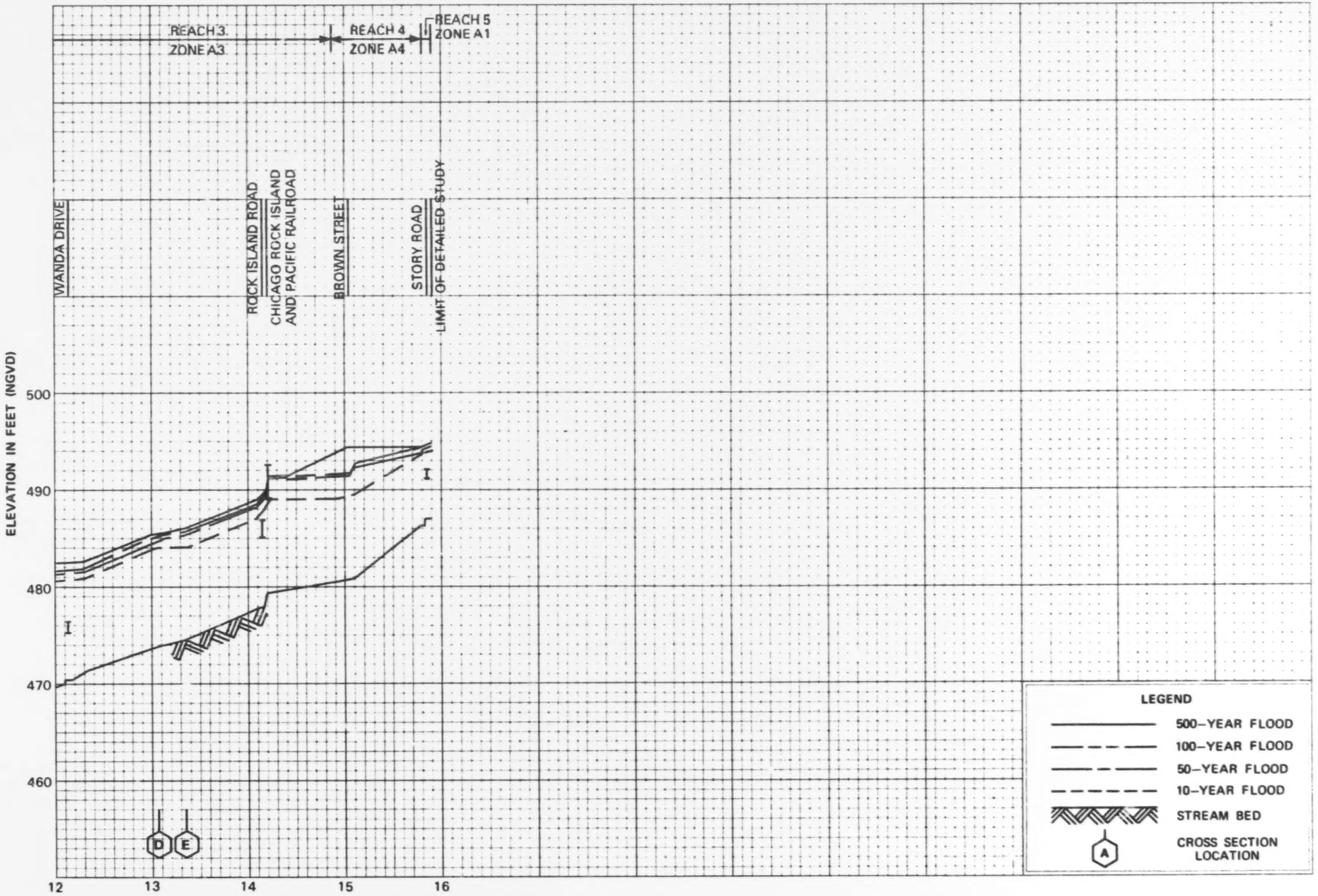
FLOOD PROFILES

WEST IRVING BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

26P



FLOOD PROFILES

WEST IRVING BRANCH

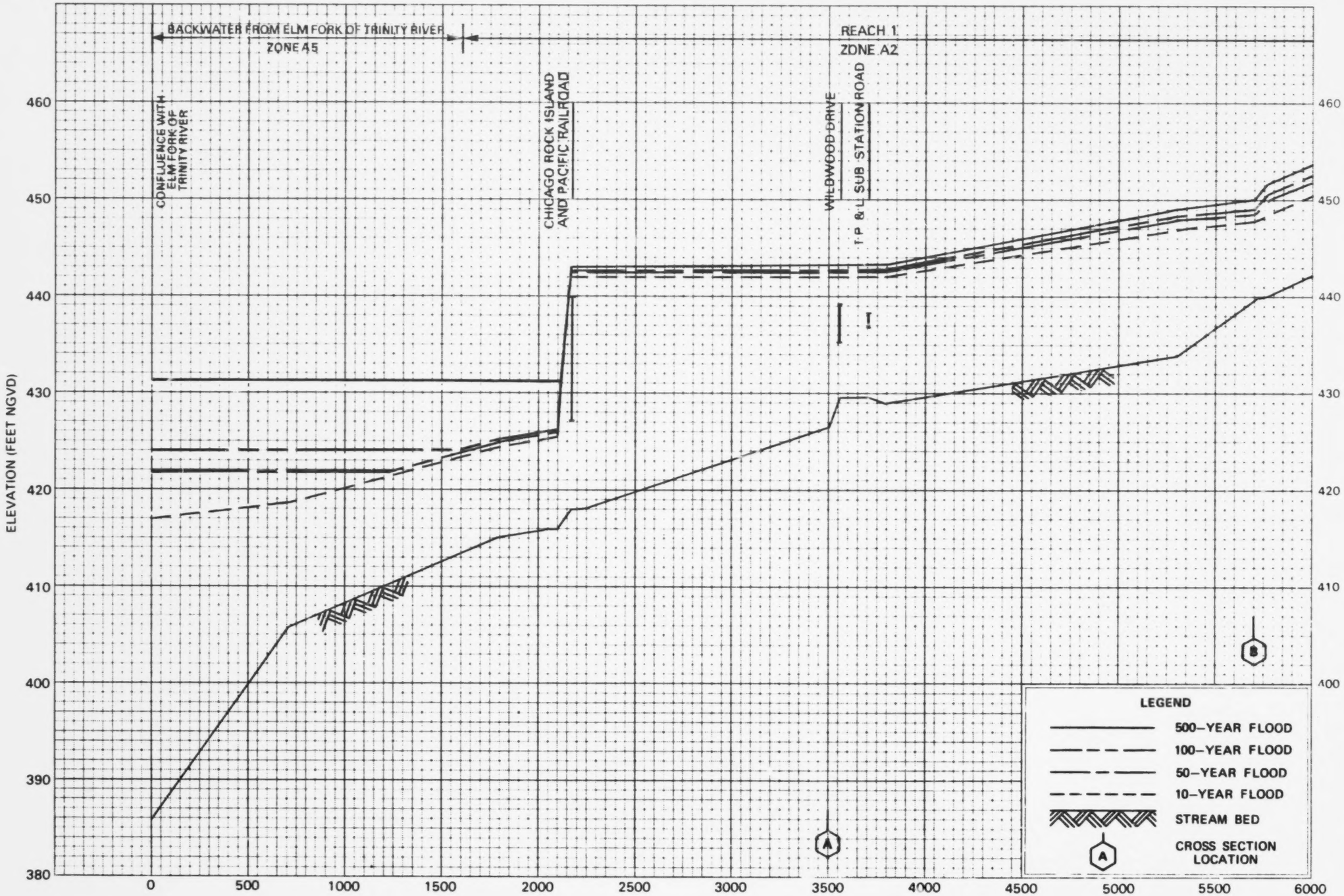
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX

(DALLAS CO.)

27P

57



FLOOD PROFILES

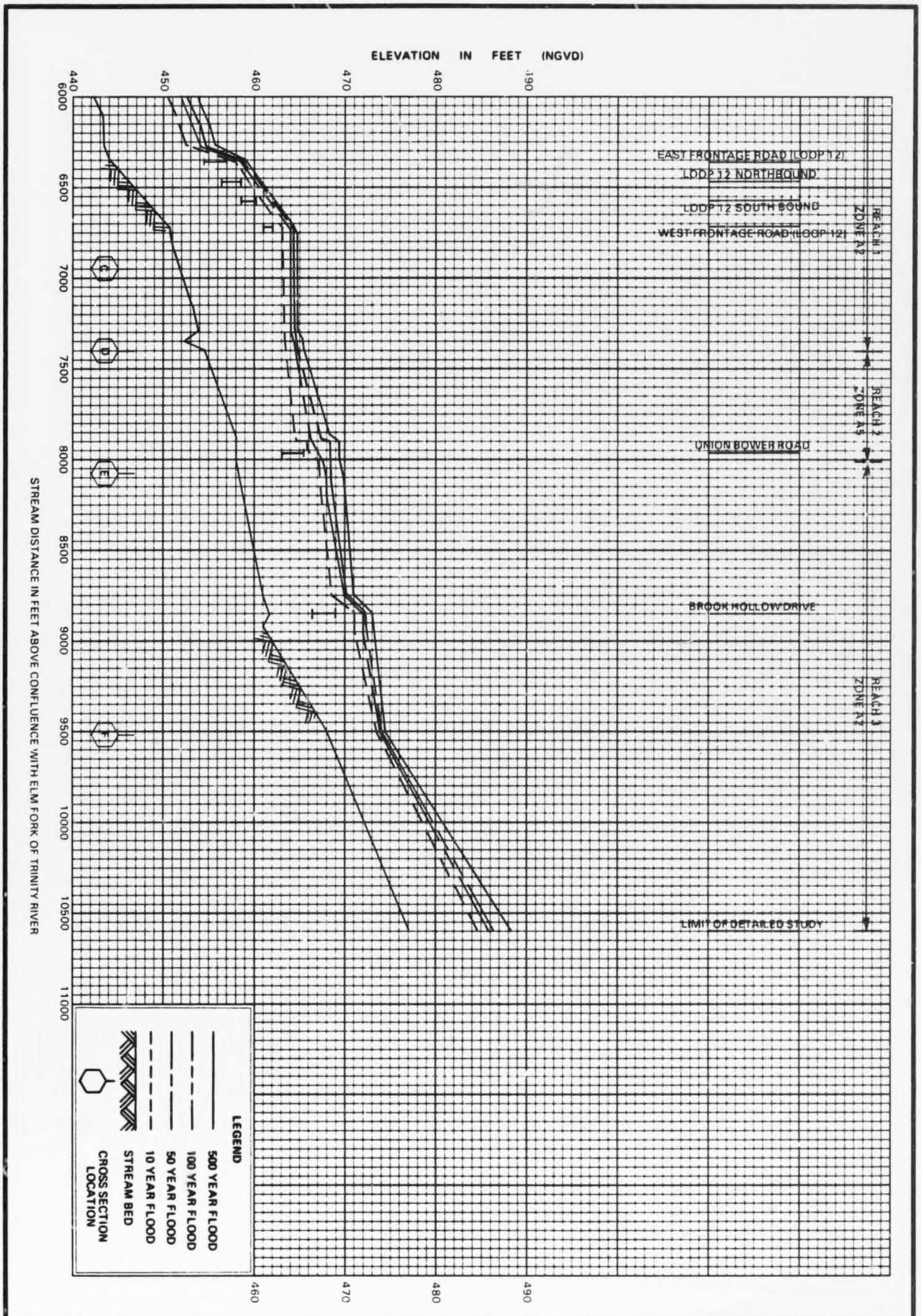
STREAM 7C2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

28P

5F



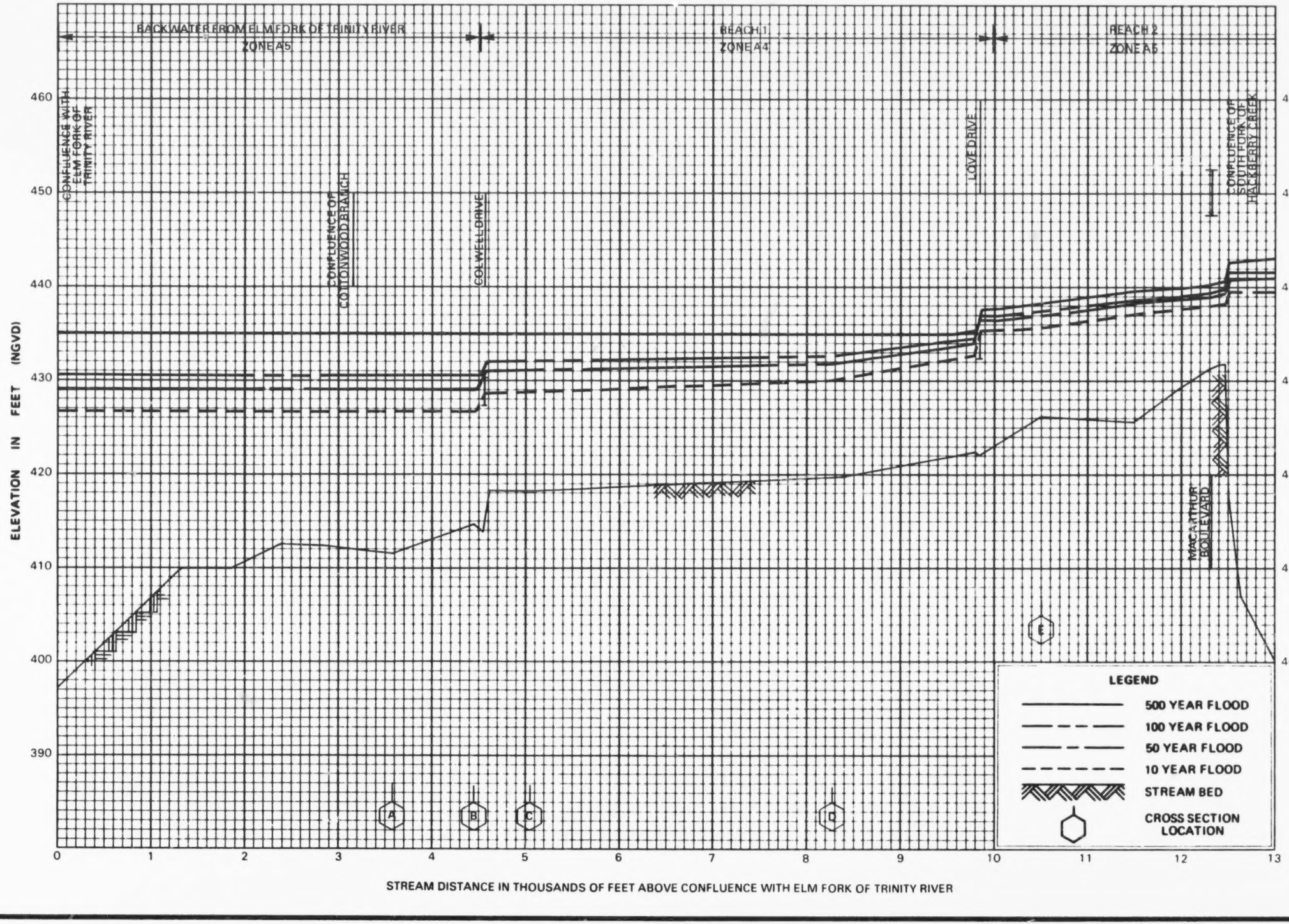
29P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOOD PROFILES

STREAM 7C2



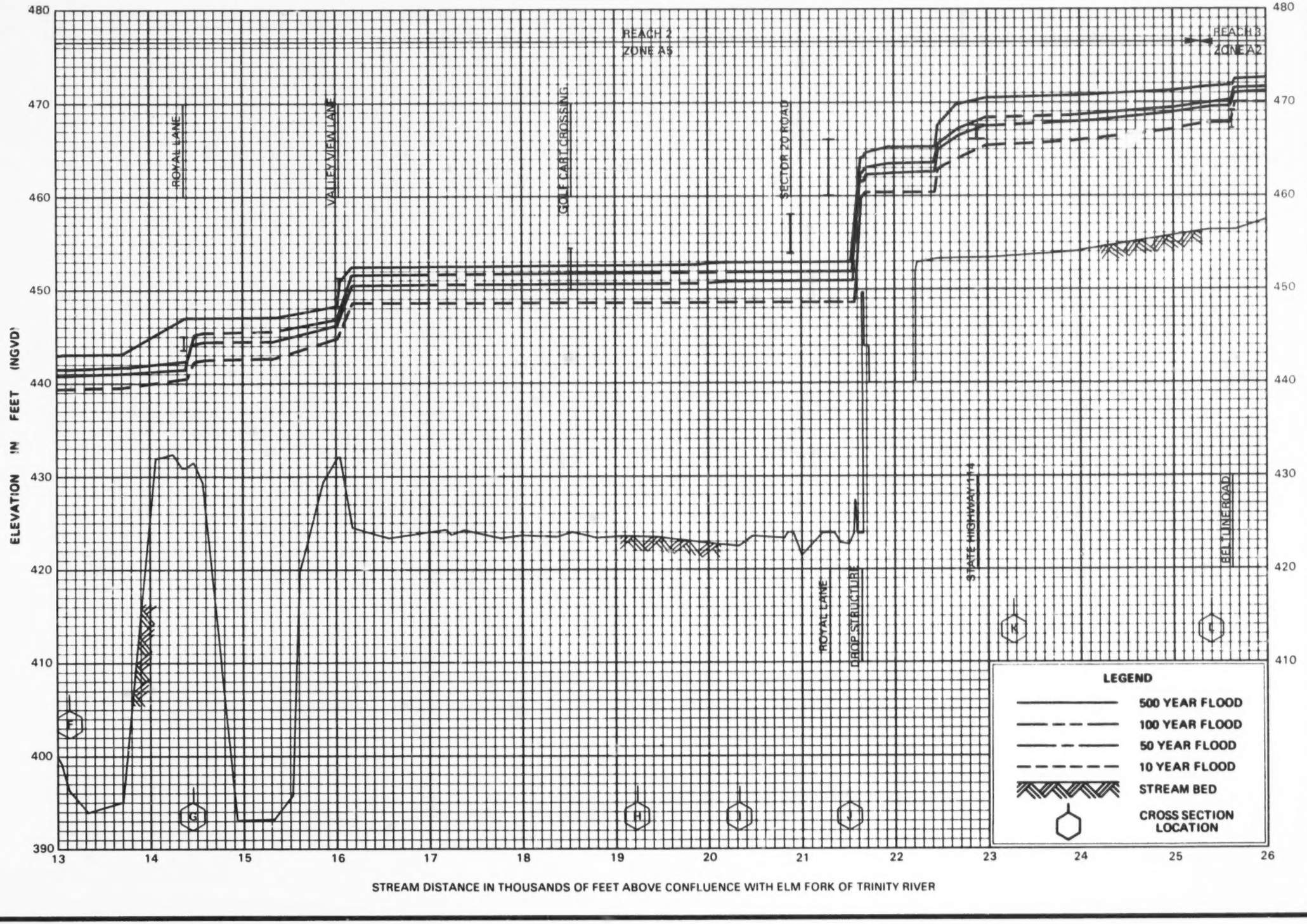
FLOOD PROFILES

HACKBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

30P



FLOOD PROFILES

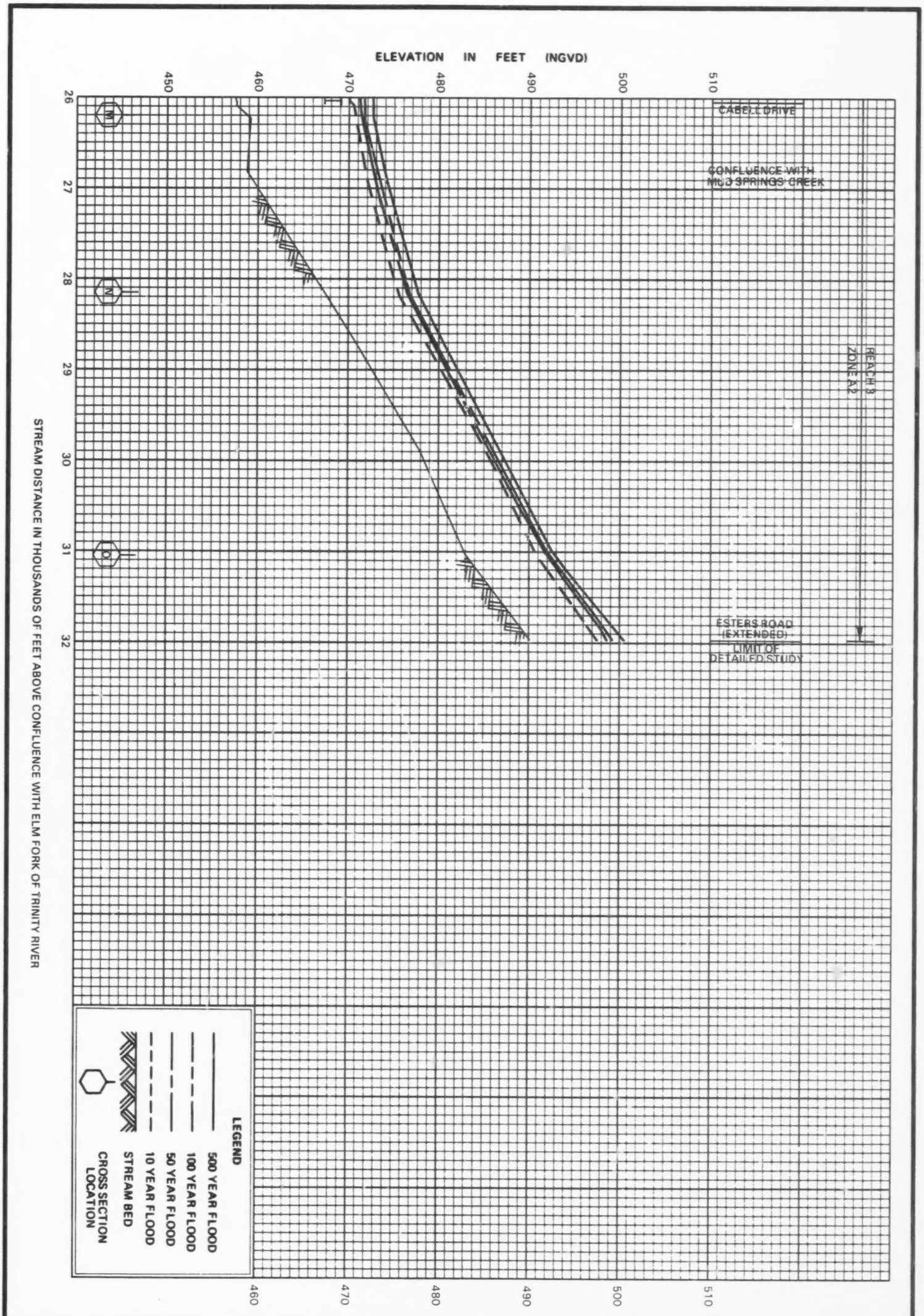
HACKBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX

(DALLAS CO.)

31P



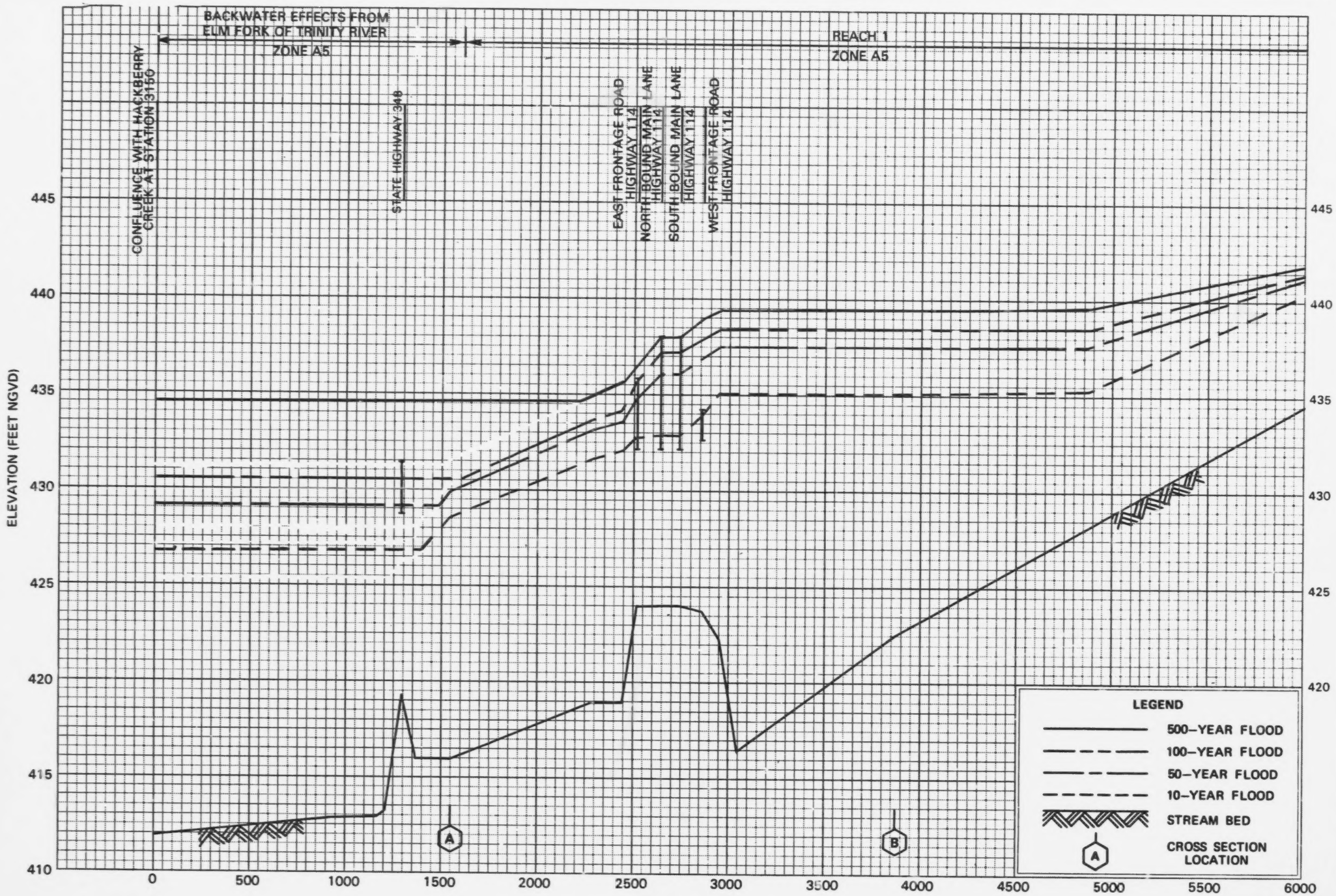
32P

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

FLOOD PROFILES

HACKBERRY CREEK



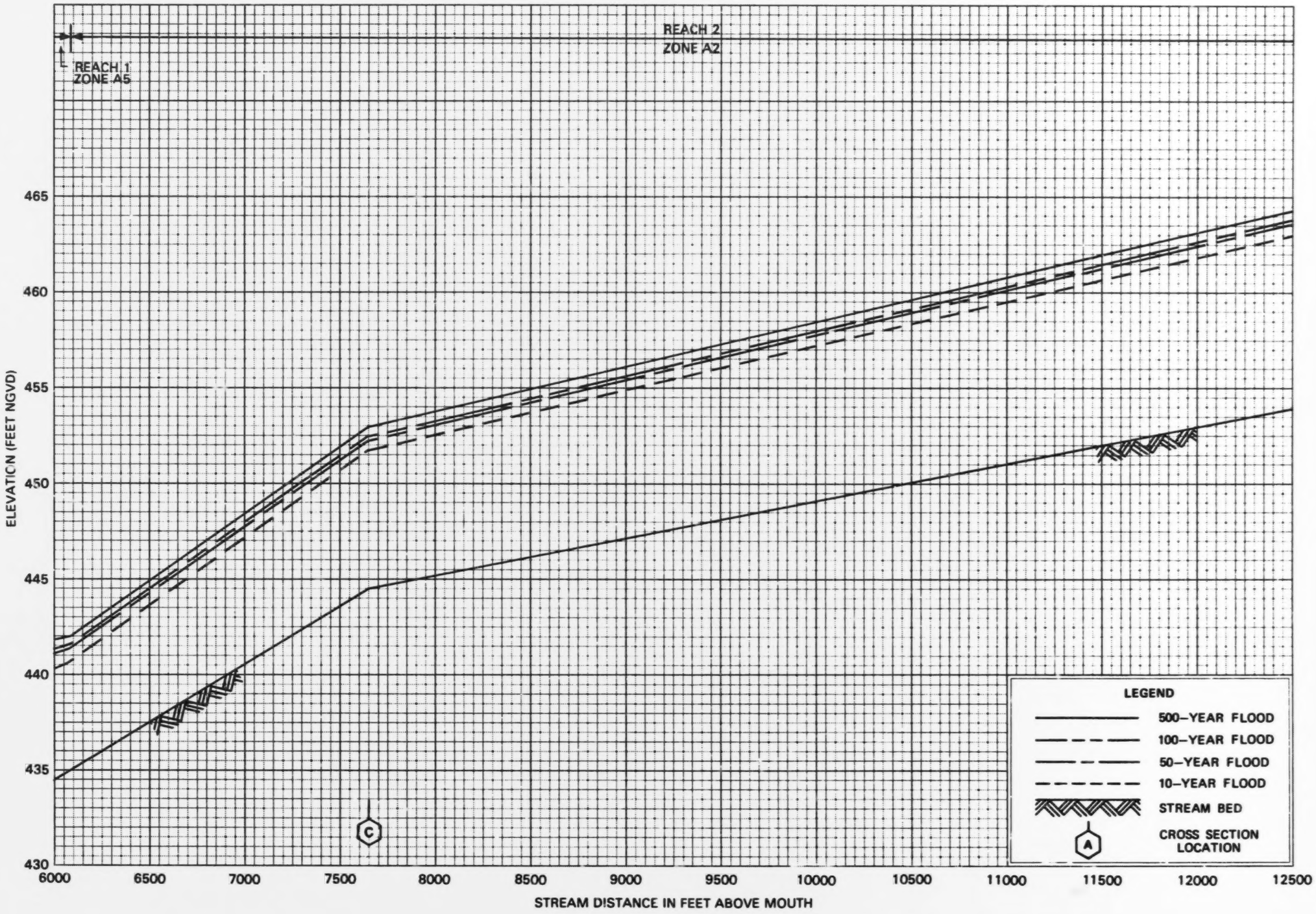
FLOOD PROFILES

COTTONWOOD BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

33P



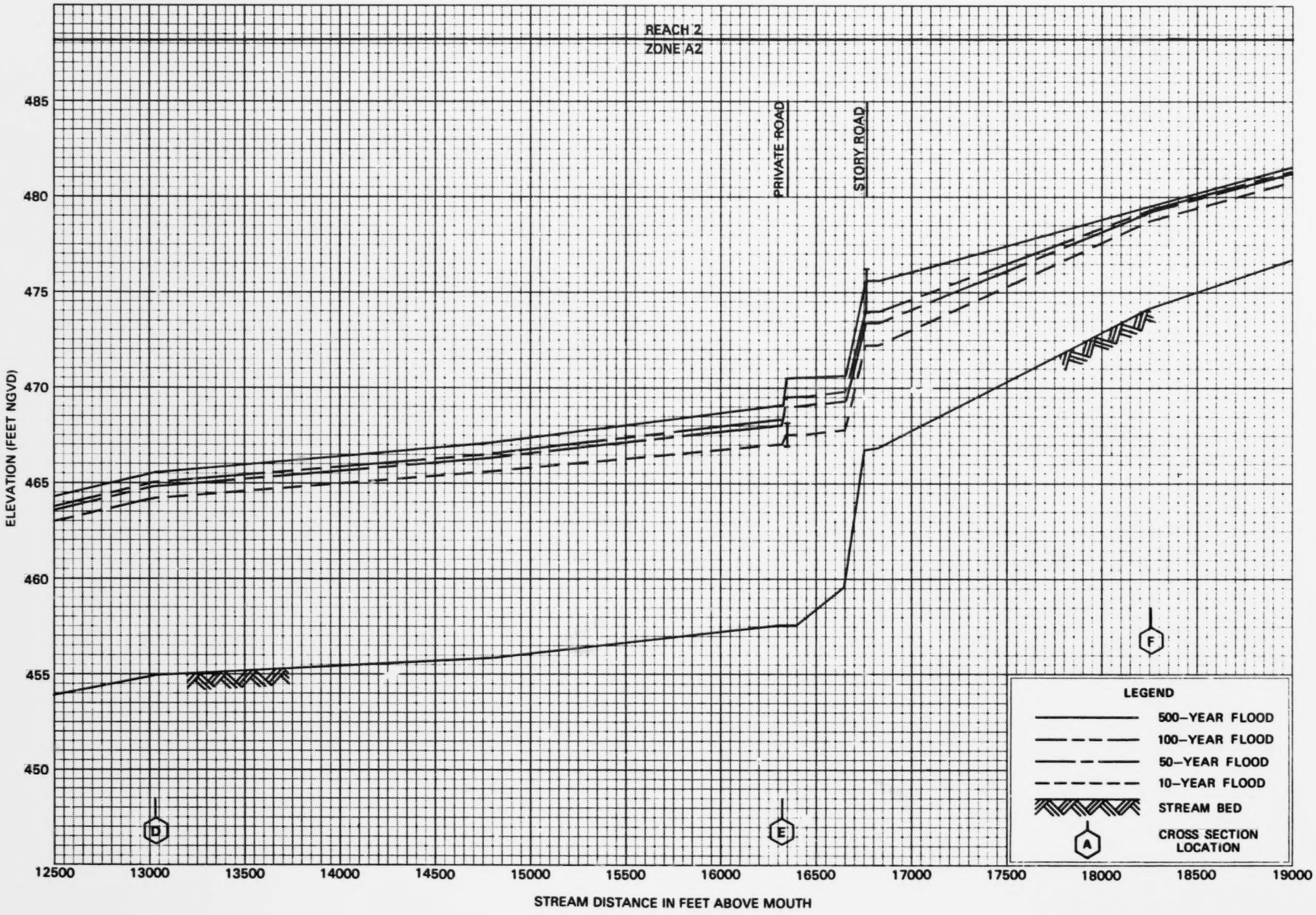
FLOOD PROFILES

COTTONWOOD BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

34P



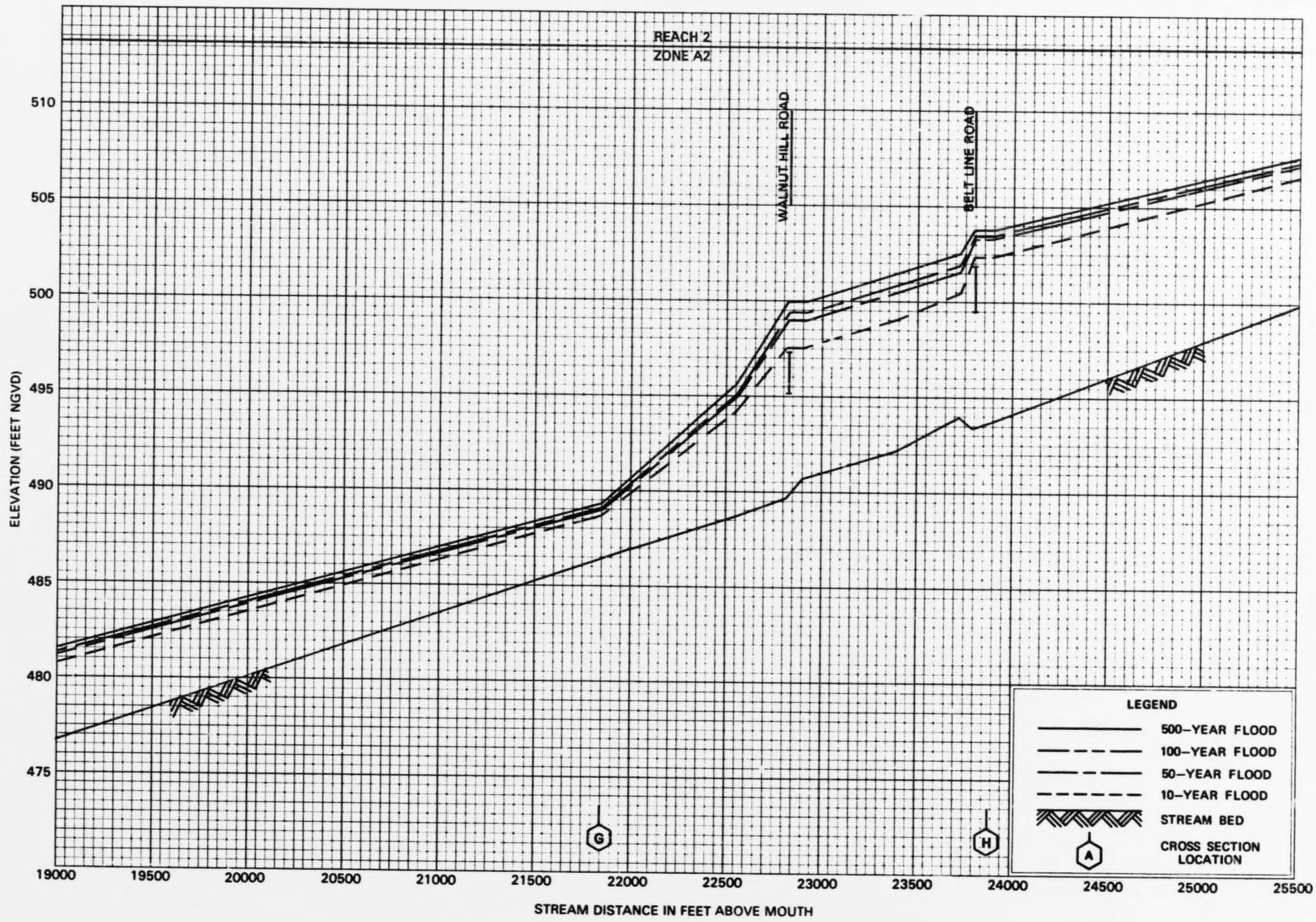
FLOOD PROFILES

COTTONWOOD BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

35P



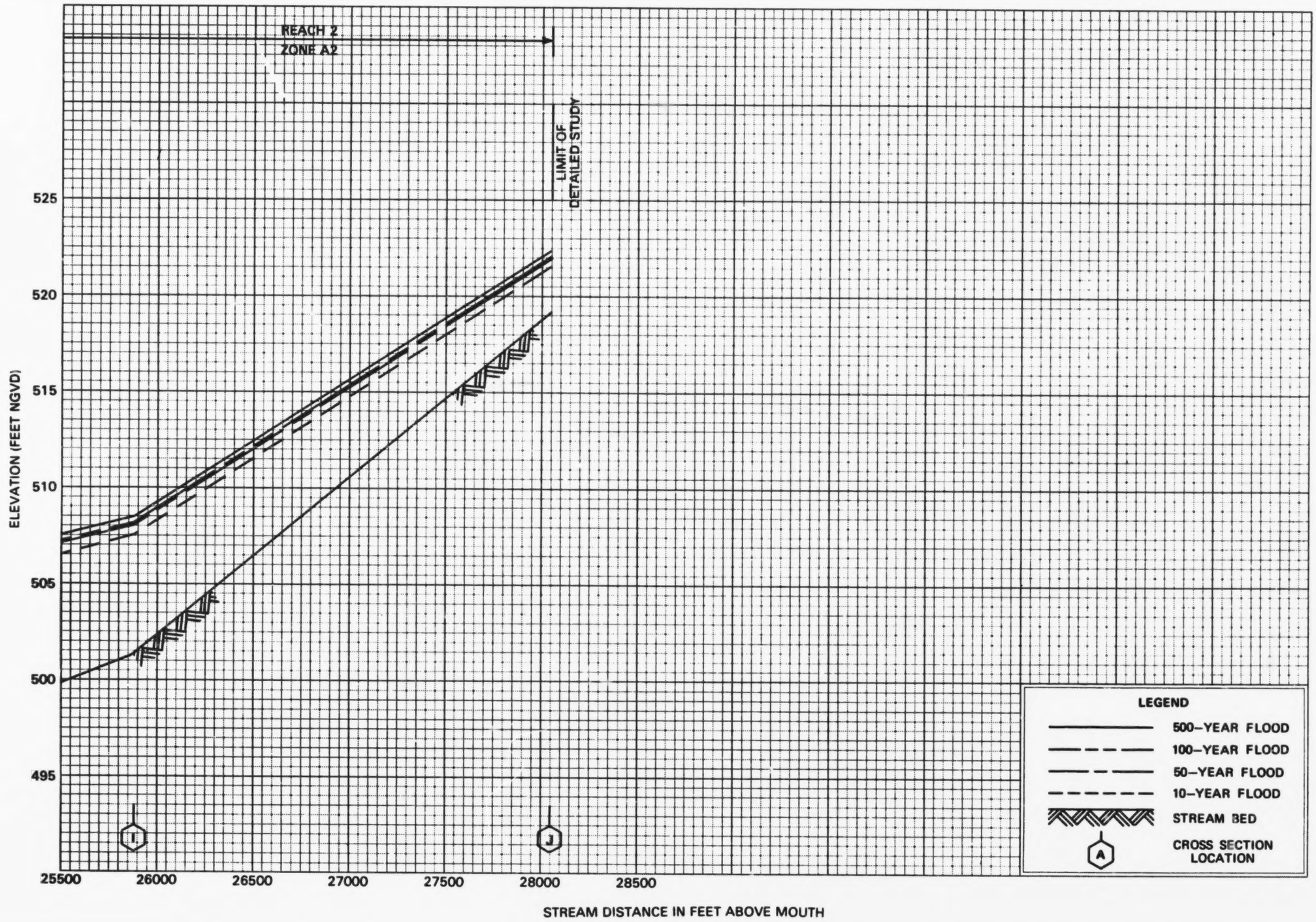
FLOOD PROFILES

COTTONWOOD BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

36P



FLOOD PROFILES

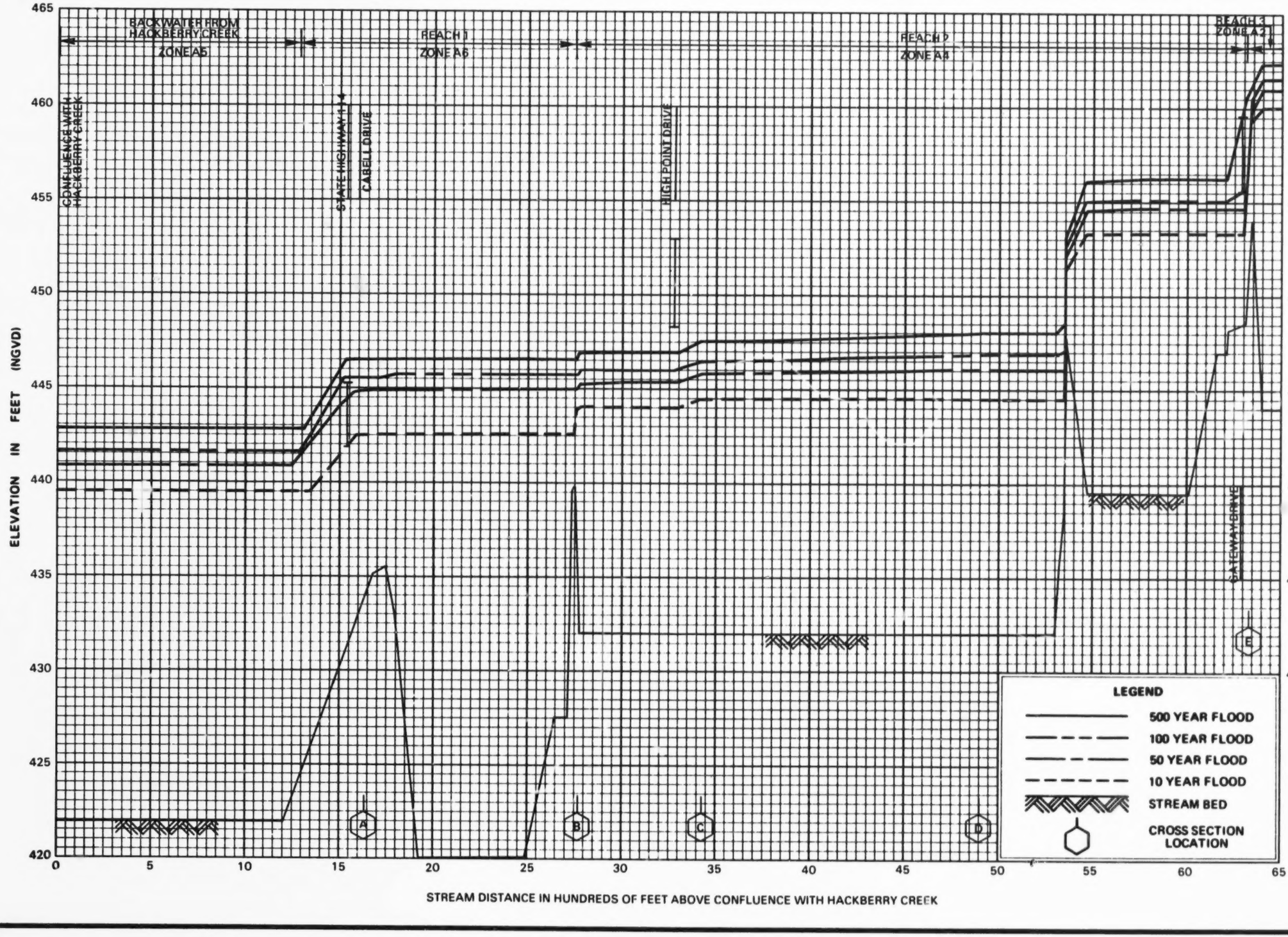
COTTONWOOD BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX

(DALLAS CO.)

37P



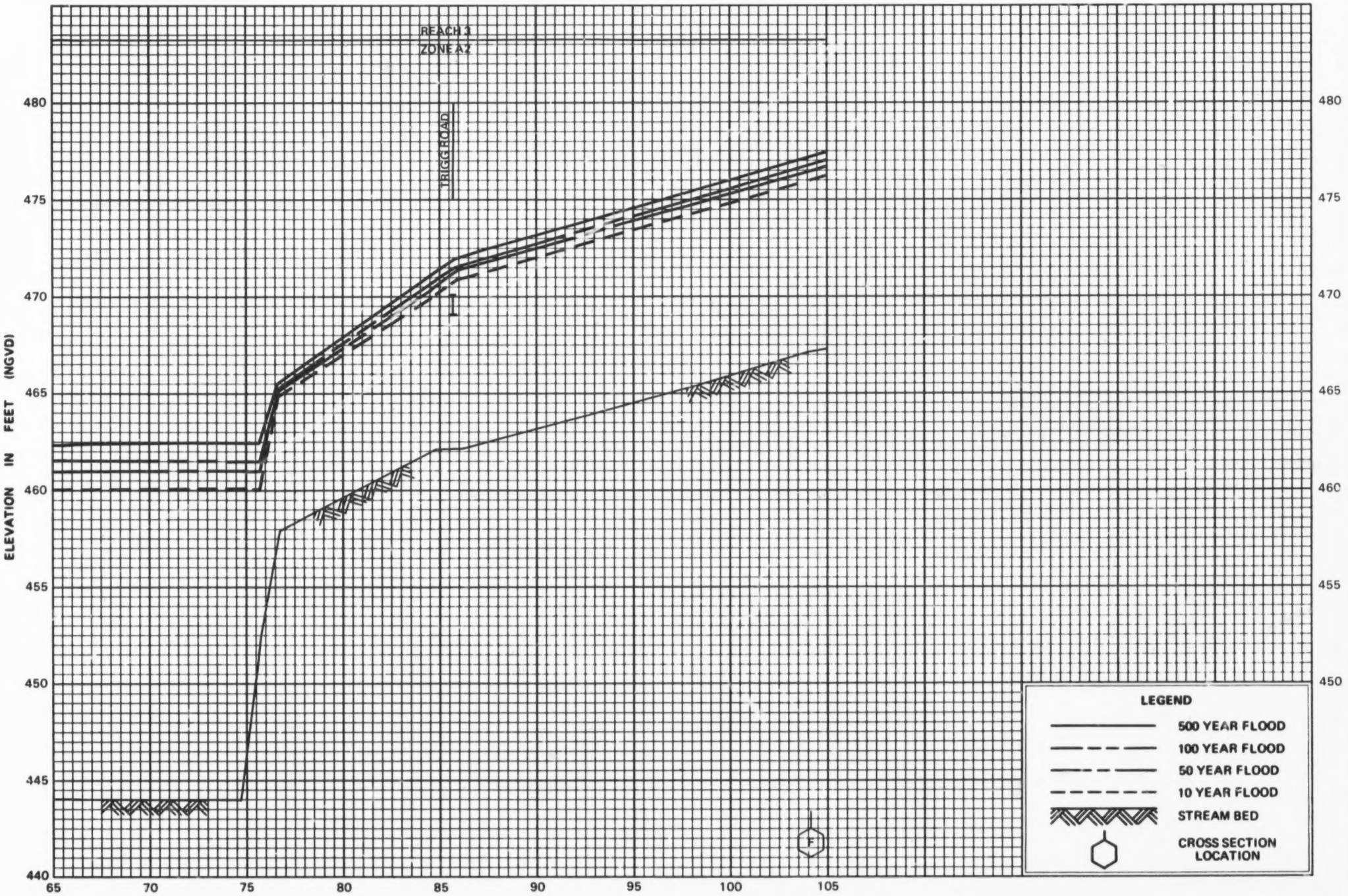
FLOOD PROFILES

SOUTH FORK OF HACKBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

38P



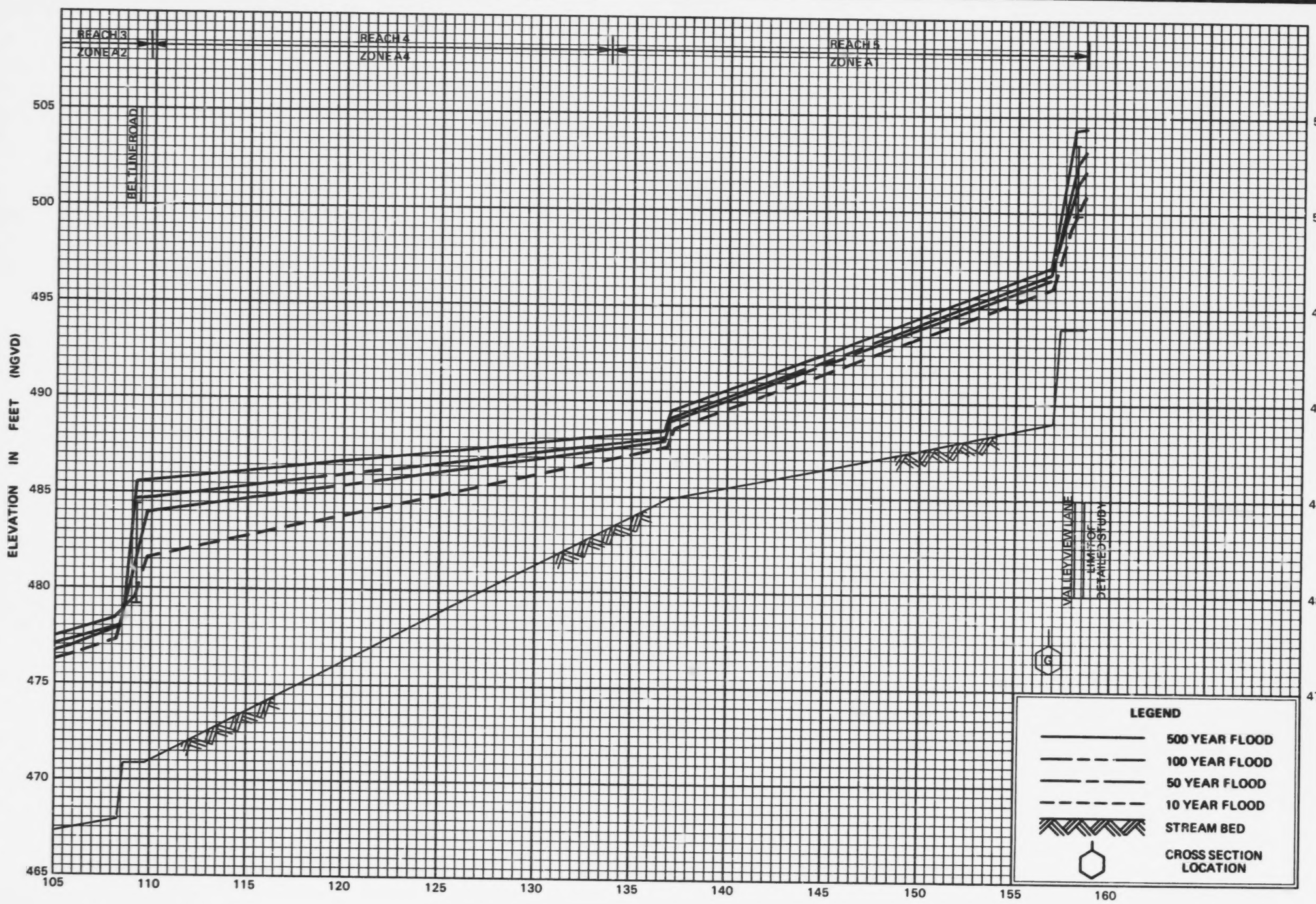
FLOOD PROFILES

SOUTH FORK OF HACKBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

39P



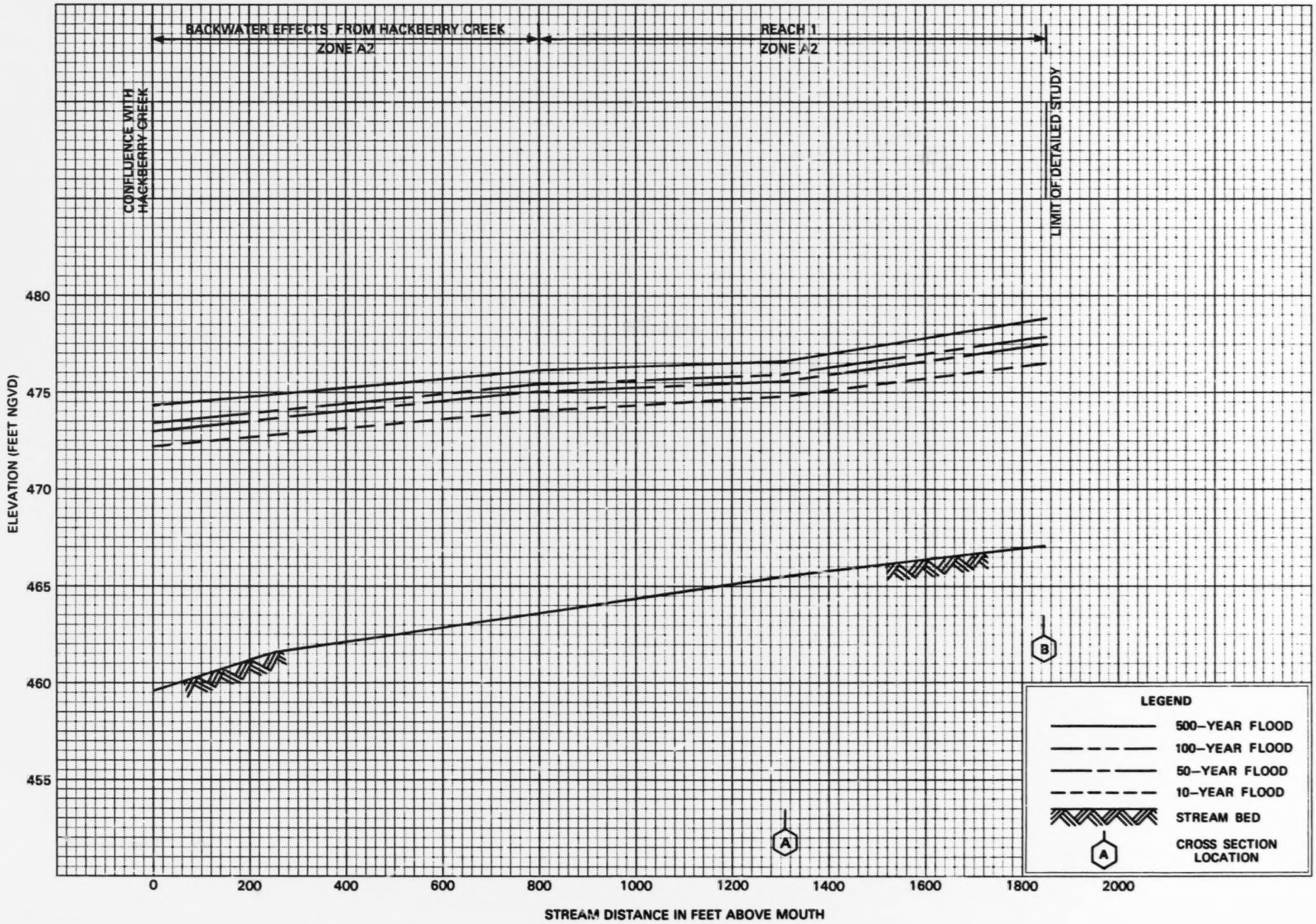
FLOOD PROFILES

SOUTH FORK OF HACKBERRY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

40P



FLOOD PROFILES

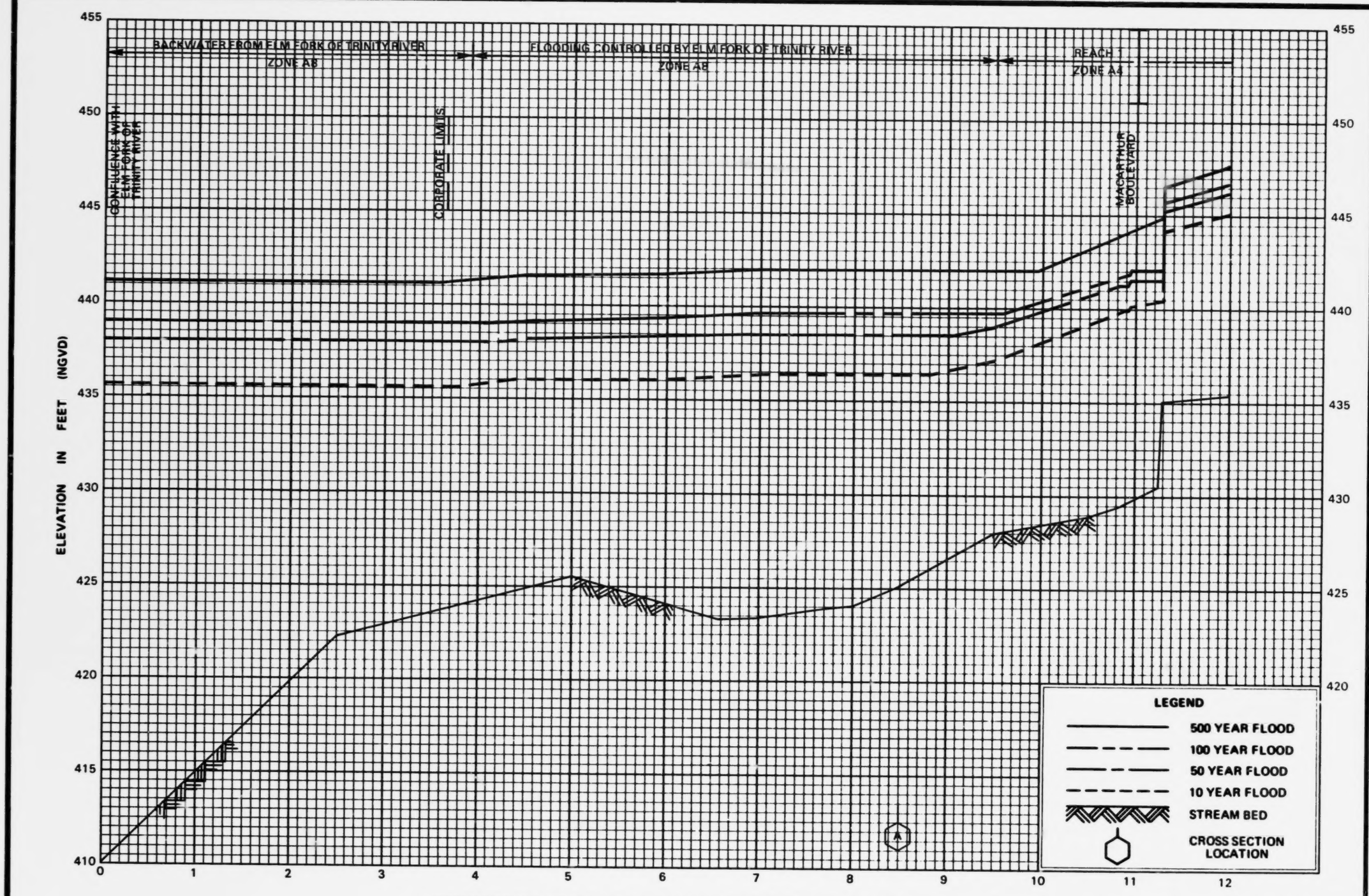
MUD SPRINGS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX

(DALLAS CO.)

41P



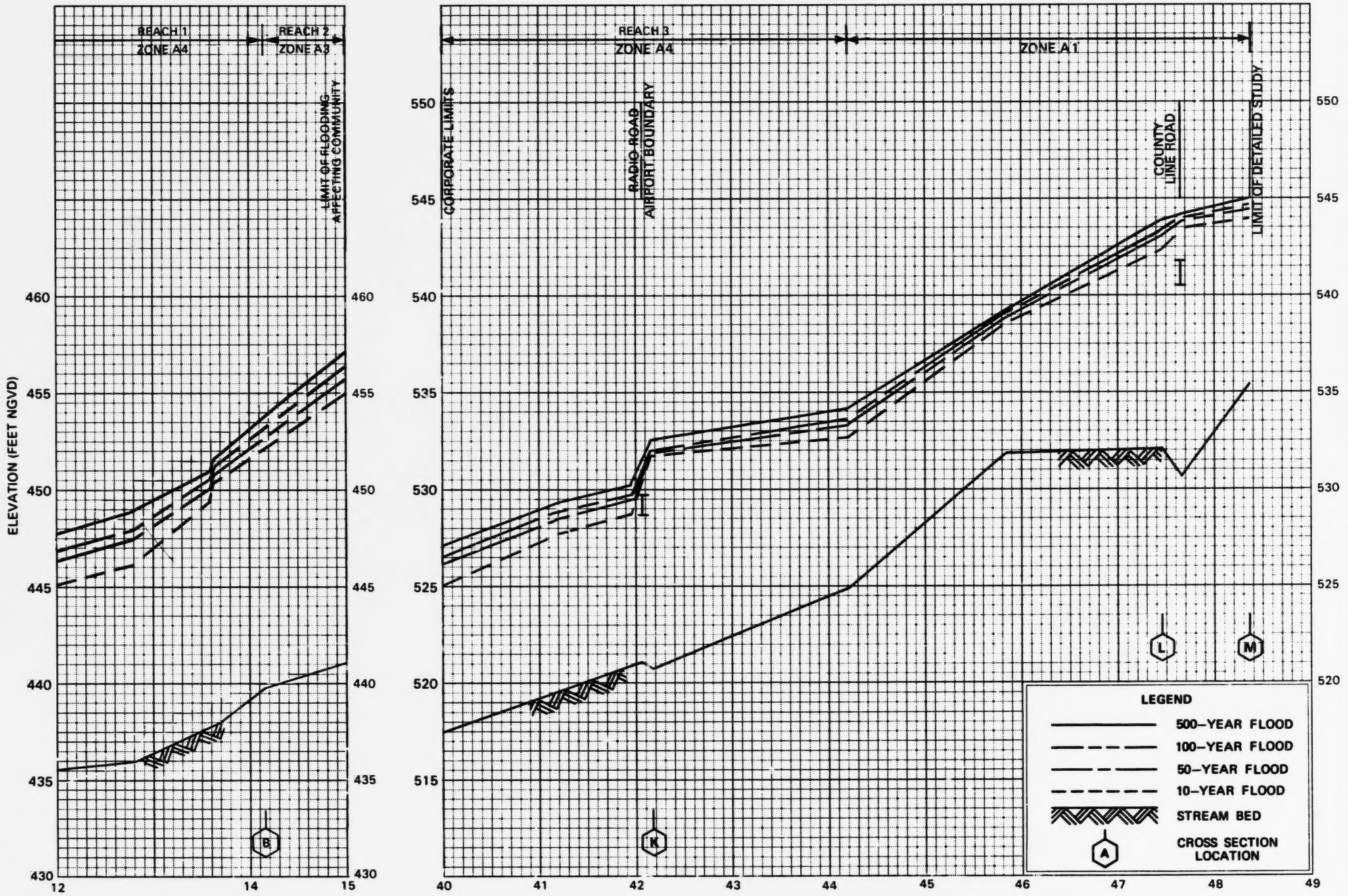
FLOOD PROFILES

GRAPEVINE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

42P



FLOOD PROFILES

GRAPEVINE CREEK

TEXAS EMERGENCY MANAGEMENT AGENCY

CITY OF IRVING, TX
(DALLAS CO.)

43P